THE UNIVERSITY OF ALBERTA

PERSONALITY FACTOR HYPOTHESES TESTED CROSS-CULTURALLY

by

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A THESIS

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ABSTRACT

The purpose of the study was to test the transferability to a Francophone population, of factors putatively assembled from large item-factor-analyses of English language personality items. To this end the English (HPQ, 120 items, 10 factors) was translated into French and administered to male and female students (567) attending Francophone Universities in the Province of Quebec. The data analysis was structured into three parts: (a) dealing with empirical replicability of the factors, in this part, scale scores were included in a Principal Components factor analysis as a means of assessing factors in terms of marker aggregations to the overall scale scores (c.f., "method of sums") (b) concerned with assessing the itemetric properties of the factor scales (c) an image analysis in which only the questionnaire items and sex variable were included.

The results of these three aspects of the analysis appear to mutually support a conclusion that despite translation into another language, the factors of Sociability (SY), Adjustment-Emotionality (AE), Dominance (AD), Super-Ego (SG), Hyprochondriac-Medical (HM), Impulsivity (IP), Co-operativeness-Considerateness (CC), Inferiority (IF),

Persistence (PS), and Trust vs. Suspicion (TS) are recoverable in terms of markers (i.e., the <u>putative</u> factors were recovered as <u>empirically found</u> factors).

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This study is concerned with assessing the factorial validity of a personality inventory. The introduction will first serve to indicate what is meant by factorial validity within the traditions of the psychometric usuage of factor analysis. In this context the object of factorial validity will be shown to predicate certain research principles. Implications for the construction of factor analytic inventories will be discussed and certain factor analytic issues will be touched upon. Contemporary factor analytic inventories will be reviewed and the etiology of the inventory under scrutiny here will be described.

Factorial Validity

Factor Analytic Rationale

Factor analysis is here advocated as a method of explicating in terms of their empirical referents, the basic constructs within a domain and in particular the personality domain. This position is consistent in principle with the traditional view of common-factor analysis (Thurstone, 1947). According to the traditional view, several broad classes (domains) of behavioral phenomena are assumed to be functions of relatively independent subsets of common traits, e.g., cognitive traits, personality

traits, sensory traits, motor traits[1] (Thurstone, 1934, 1938; Fleishman, 1965).

Hence, the assumption is first made that the stable or gross behavioral phenomena within a domain are indications of relatively unitary (and hence distinguishable) common traits. Factor analysis has been (and is here) advocated as a technique for the empirical verification of this assumption. In this context the behavioral phenomena of interest are represented in terms of observable variables which are tests of the phenomena. If indeed a few common traits operate to produce the manifest variance among the tests, the analysis will reveal (a) relative parsimony in the description of the elemental manifest variance (b) relative independence of the components of variance and (c) psychological interpretability of the variance (Overall & Klett, 1972, p.90). In terms of the orientation disclosed here the analysis would provide a representative empirical definition of the relatively unitary trait constructs within a domain. This sort of definition is intended by the concept of providing a Prior Multivariate Operational Definition of Individual Differences (see Howarth, 1972a;

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1 It would indeed be impossible even on rational grounds to maintain the <u>complete</u> independence of these rational categories, nevertheless, it can be argued that the divisions are legitimate in that they provide a basic reference scheme and fractionate the total sphere of human variability into experimentally amenable portions. Furthermore, once the common traits within any domain have been operationalized they can be related to those of other domains.

Howarth and Cattell, 1973).[2]

Necessity of Prior Multivariate Operational Definitions (PMOD)

Howarth (1969, 1972a) & Howarth & Cattell (1973) have emphasized the need for Prior Multivariate Operational Definitions of concepts. One basis of their argument stems from the fact that operationally a multiplicity of manifest behaviors comprise the substrate of abstract psychological concepts such as anxiety, learning or sociability[3].

This implies that unless (within relative bounds) the isomorphic behavioral indices of a particular concept are multipli-specified, (representatively) veridical experimental generalization is precluded.

In the above sense typical bivariate experiment[4] appears to suffer from two unwarranted presuppositions which Howarth (1969, p.32-33; 1972a) has termed "the error of common sense" and the "error of individual differences".

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2 Given that multivariate operationalization of concepts appears to be required (to be discussed); it follows that a description and measurements basis of the relative position of individuals vis-à-vis trait concepts be ascertained before one can attempt to determine why or how they got that way i.e., state laws preceed process laws.

3 This may appear to be a tautologous statement however, judging by the number of bivariate experiments the equality does not appear to be appreciated and is here stated for emphasis.

4 By typical bivariate experiment is meant the operationalization of two concepts in an experiment in terms of single rationally selected (hence dimensionally arbitrary) manifest variables.

The "error of common sense" concerns (a) the dimensionality of a manifest variable and (b) the generalizability of a single variable. In sum it is the assumption "that we know what we are measuring from a single (or restricted group of) measures" (Howarth, 1969, p.32)[5]. Thus, although the fundamental premise which permits of science is that a system has dimensionality no effort is made to ensure that dimensions, e.g., inferable abstract concepts are not being confounded, i.e., within a given space (operational field) that manifest variables are related to essentially one dimension and not a complex of dimensions. In the absence of known uni-dimensional variables, bivariate experi-

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5 "Let us take an example. Suppose we carry out the dermographia measure. One way this can be done is to exert a pressure on the inner surface of the upper arm where the pigmentation is reduced. The pressure is exerted by an instrument which gives x kg, and the pressure lines, of y cms, are crossed at right angles. After a given time, the reddening becomes apparent and finally after times ranging from several minutes upwards, disappears. We believe we are measuring a local autonomic response to a stressor but this is, in the first instance, subject to autonomic balancing. Secondly, it is a single personality measure, i.e., the dermographic latency is highly correlated with a 'personality factor', but it is of no use whatever to think of, or to specify, a personality dimension by one measure, however 'good' that measure. The factor is located by several measures, and the factor has 'meaning' only from a group of measures. Similarly, one can measure an aspect of learning or reaction time, or threshold by one measure but we are only taking a small corner of the performance. When we ask, 'What does this measure?' we should be careful not to fall into the error of common sense. Suppose that one wished to measure the effect of drug A on concept formation. How then are we to tap 'concept formation'? If we choose test B as our operational definition, how do we know that we are adequately penetrating the space of concept formation?" (Howarth, 1969, p.32).

ments will be susceptible to both type I and type II errors (for details and examples see Howarth, 1969, p.40-42).

Another investigator who has clearly spelled out the need for universal and structured variables is Horst who states:

> It is all very well to say that each investigator can define the variables which interest him in any way he pleases and devise methods for measuring these... The difficulty is, of course that if each psychologist chooses or defines his own variables without respect to the way other psychologists select and define their variables, the inevitable outcome will be a vast conglomeration of unorganized, unstructured variables which far from clarifying our understanding of human behavior, serves further to confuse it...Psychologists have been engaged, it turns out, in building a Tower of Babel...Fortunately, within the last four decades a methodology has been emerging which gives considerable promise of bringing order out of this chaos. This methodology has come to be known as factor analysis (Horst, 1966, p.143).

Factor analysis is thus a general scientific method capable of analyzing the variance of an operational field into its relatively unitary dimensions thereby providing a measurements basis for abstract psychological concepts. The present task then involves describing the operations as they apply to Personality research.

Domain Representation

The first requirement in conducting a factor analysis is that the domain be defined. Domains, it appears are

largely conceived as givens, thereby vitiating the need for adequate definition. Strictly, a domain refers to that range of phenomena represented in an analysis. Thus if one is merely representing a small portion of the cognitive domain, the personality domain, or any other broad rational category there is an onus on the experimenter to define the range of phenomena represented, thereby avoiding the misunderstanding that the structure of the primary variables within these broad domains has been mapped. For example of the Personality domain Eysenck asserts: "The belief sometimes echoed by text-book writers, that the main primary factors of personality description have been identified by Cattell or Guilford is clearly premature...Much long and arduous work still lies ahead before we can claim to know very much about the structure of personality at the primary level" (Eysenck & Eysenck, 1969, p.238)[6].

Ideally one would sample in a statistical sense from a transfinite population of tests which have been defined as belonging to a particular domain. However, domains are not given, nor is a population of tests, hence the problem amounts to operationalizing the concept of a population of tests such that the intended behavioral gross is represented. From this vantage point, one might proceed from a universe

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6 Ironically, one might expect that an assessment of the potential of factor analysis (Lykken, 1971) might await an optimal tactical use of that method (see _Factor analysis has only begun to fight_, Howarth, 1972).

defined by Cattell's 171 bipolar traits[7] (Cattell, 1946) and proceed systematically in terms of a data base[8] (e.g., Q media personality items) to determine empirically the referents of these traits in terms of factor hypotheses.

For the present, a more relevant approach is that upon which the HPQ[9] is based. That is, within the data base of personality items, represent in an analysis a majority of those items which have been employed over the past fifty years in terms of several factor hypotheses derived from the overlapping item content of a large number of questionnaires. In this way it is possible to represent in a single analysis those aspects of personality

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7 Clearly one can appreciate Cattell's notion of a personality sphere without agreeing with his research tactics and his empirical results which in effect were largely confined by the computational facility available in 1946.

8 The data base employed here is questionnaire media personality statements, of course other media are possible e.g., ratings, objective tests (Cattell, 1957) as well as other modes e.g., adjective check list (Anderson, 1968; Parker & Veldman, 1969). Ultimately, the interpretation of _personality_ factors, qua dimensions, must await the empirical verification of the "principle of indifference of indicator" (Spearman, 1927). To date the evidence for cross media equivalence is not impressive e.g., see Becker, 1960; Skinner & Howarth, 1973; Shaie, 1962).

9 Howarth Personality Questionnaire--the putative item pool on which the present French translation was based was the fourth (HPQ, HPQ , COS, PFI) attempt to assemble a pool of items which would represent, by means of a number of marker items in each putative factor, the most replicable factors in this _type_ of instrument, with this _type_ of question, and with this _type_ of scale, etc.

which have up till now occupied psychometricians. This point will be further discussed as the etiology of the HPQ is described.

Of general interest, it should be pointed out that several repetitions of identical item content will likely result in tautologous factors of little psychological interest (Eysenck, et al., 1969, p. 216); the problem becomes one of representing similar but not identical items so as to obtain structurally broad (combinatorial) factors.

However, it is recognized that it may be necessary to sacrifice density for broad scope of representation; nevertheless, the position assumed here is that any veridical assessment of factorial validity must be referenced both to the range and depth of the phenomena represented.

Simple Structure

The validity of a factor analysis must be evaluated in terms of the simple structure obtained. In the absence of a good simple structure, whether oblique or orthogonal interpretation is likely to be obfuscated hence very subjective and to some extent defeat the objectivity of the method. It is important to realize that Thurstone's (1947) interpretation of a factor as a unitary psychological trait was based on the reduction (i.e., vanishing of the tetrad differences) of the correlation matrix of a subset of variables to rank one. Geometrically excepting distribution factors (to be discussed) this corresponds

ideationally to a Guttman scale in hyperspace with the variables of a factor falling exactly on the factor axis. Such variables are perfectly homogeneous being mutually intercorrelated to the extent of their communality. This point was emphasized by Comrey:

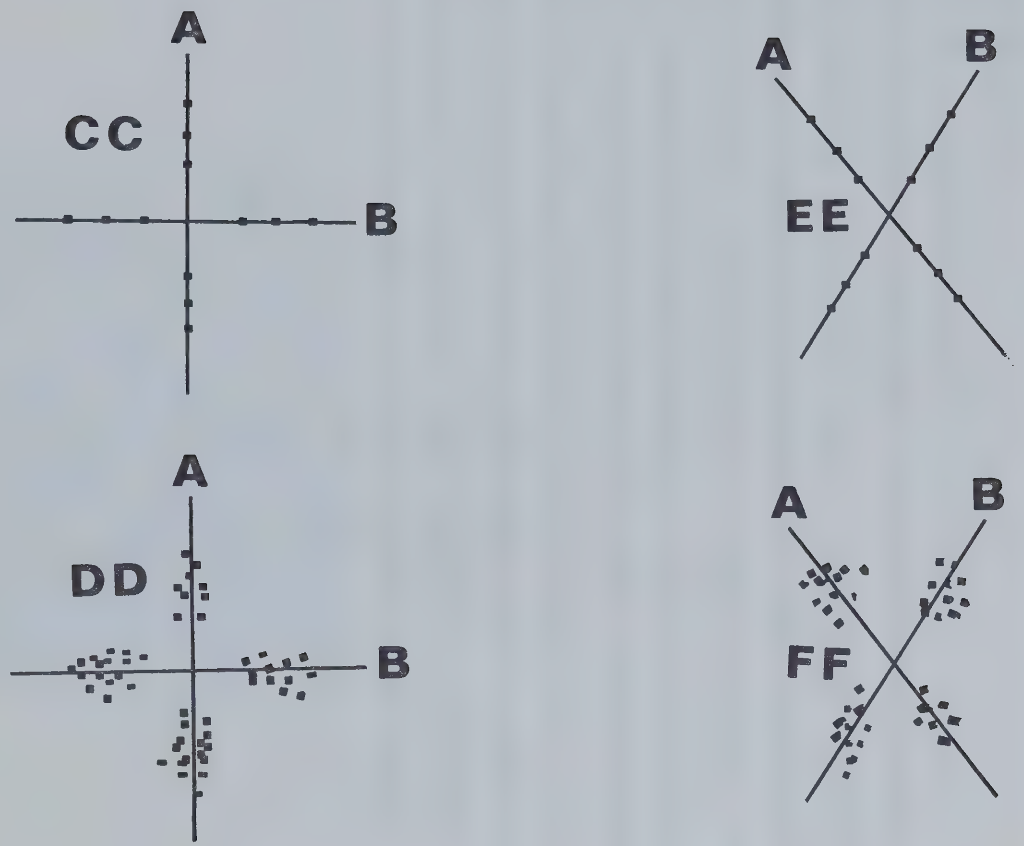
> conceptually a factor pure scale is a homogeneous scale such that if any two other scales are found which correlate with it they must also correlate with each other (Comrey, 1961)

For the purposes here, the constraint of orthogonality is dropped and clear oblique simple structure is seen to permit the inference of a relatively unitary trait (see Fig. 1). However, it has been argued by Cattell (1964) that it is possible in the absence of good simple structure (where the variables are factorially complex) to have relatively low homogeneity among the variables loading on a factor. Unfortunately, Cattell has termed such variables to be "factor true" and holds that low homogeneity is indeed desirable. However, such factors must be considered statistical factors and their psychological interpretability can be compared to unrotated factors. As pointed out by Howarth, Browne & Marceau (1972), Cattell is clearly inconsistent in this respect, in that factor trueness in the absence of high homogeneity is incompatible with simple structure which is the basis of his system. Their argument on this point states:

1. Geometrically--"Simple structure (which Cattell advocates and uses) demands that in general salients on

Figure 1

SIMPLE STRUCTURE



CC--Ideal orthogonal simple structure

DD--Acceptable orthogonal simple structure

EE--Ideal oblique simple structure

FF--Acceptable oblique simple structure

one factor be in the hyperplane of the other, as far as possible. Salients on the reference vector of the first factor must lie close to (i.e., within the hyperplane) of the second factor. They must be well out on but close to any axis. Even though on either side (positive and negative) they must show other than low or zero intercorrelation" (see Fig. 1).

2. Algebraically--"If two variables are appreciable salients on one factor, and if the remaining loadings of each variable are low, as they are likely to be in simple structure, then the inner product of these intercorrelations cannot be low or zero" (Howarth, Browne & Marceau, 1972, p.89).

Thus factorially homogeneity of the variables loading on a factor is not only compatible with simple structure but is a necessary condition for its occurrence. In its absence we have variables correlating with a statistical criterion of no particular psychological significance. This point has been dealt with by Horst who reasons:

> The argument is frequently made that it might be desirable for a given test to sample a large number of different variables which are not highly correlated so that one gets a wider sampling of whatever it is that he is trying to measure. Here we shall only say that if a person is attempting to measure a large number of things, then he should specify as accurately as he can what each of the things is and should attempt to measure them separately by separate groups of highly correlated items (Horst, 1966, p.147).

It should be noted that factor purity, or a good simple structure means that in general the communality of a variable will be largely accounted for by only one factor thus, when communalities are low the homogeneity expressed as the average inter-item correlation may still be quite low. Thus in assessing simple structure (loadings of all variables on all factors) in terms of homogeneity the communality of the variables must be considered.

To conclude, a Guttman type configuration in hyper-space located on a factor axis corresponds to Thurstone's notion of simple structure which permits the inference that a unitary trait is operative. However, it is possible to have statistically valid factors which do not display a simple structure. In such cases there is little basis for the interpretation of a factor as a psychological trait. It follows that the quality of the simple structure must be assessed and included as a parameter of factorial validity.

A veridical assessment of the factorial validity of a particular analysis in addition to demonstrable reli-ability (replicability) must (a) be prefaced by a rather explicit description of the domain represented in the analysis, i.e., valid within what range of phenomena (b) take into account the quality of the simple structure, since interpretation of factors as unitary traits requires that the variables exhibit a simple configuration vis-à-vis the factors.

In this context a factor is valid (assuming that it is

reliable) for a specified domain to the extent that it provides a parsimonious description of a relatively unitary trait construct in terms of its relatively homogeneous empirical referents[10].

It will be shown later that few existing empirical personality factors can assert a claim to validity according to the above criterion. Indeed it will be found that they do not even satisfy the requirement of replicability. To the extent that the HPQ is found to be valid the assumption will be made that other unreplicable factors were based on a research strategy which was not rationally compatible with the aims described above. Let us now consider some implications for research.

Implications for Research

> In planning a factorial analysis it is desirable to cover the domain to be investigated as completely as possible with a large number of related variables,

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10 The first order stratum of sampling must be of a density such that a good simple structure is obtained i.e., for all intents this can be interpreted to mean that the salients of a given factor are relatively homogeneous. In order to have replicable primaries it seems reasonable to require that the items with the largest loadings (salients) be significantly (e.g., $p<.01$) intercorrelated. As an aside this may provide an index of the appropriate saliency level adopted. In any event, if the primaries themselves are not homogeneous, regardless of the breadth of their content, ranging along a continuum from tautological (T) to combinatorial (C) there does not appear to be justification for proceeding to a second order factoring. The reasoning is that second order factors will be even less homogeneous.

> which should be experimentally representative of different aspects of the domain (Thurstone, 1947, p.313).

Since the object is to map the structure and provide empirical definitions of all relatively unitary constructs within a broad domain (e.g., Personality), it stands that progress, other things being equal, will be related to the coverage (scope/density) of programmatic studies. Given the computer facilities available today (e.g., see Howarth & Braun, (1972) for a program that can perform a principal axis factoring on 450 variables) there is no excuse when one is attempting to map a domain to employ only a few variables per analysis.

Thus, although possibly a different absolute number of variables is envisaged the position adopted here agrees, in principle, with Thurstone that analyses should be as large as possible.

With personality items approximately 100-150 variables for five or six factor hypotheses appears ideal. The above density suggests that each hypothesized factor should be represented by approximately 20 putative trait indicators. It is important to provide enough balanced redundancy[11] with an analysis such that if a simple structure exists,

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11 Again, it is important to appreciate that in the absence of a stable and replicable structure at the first order level of factoring, there is little basis for proceeding to a second order level. This implies that the first order factors be represented, by several salients, i.e., in the case of simple structure relatively highly intercorrelated items, hence a replicable composite in terms of factor markers.

it will be demonstrable in unequivocal and interpretable proportions.

These recommendations (broad representation and sufficient redundancy) appear self-evident. However, a third recommendation requires some explanation.

The variables representing a domain should be as simple (vs. complex) or elemental as possible. Given that one of the purposes of factor analysis is to determine the traits which can in some sense be held responsible for behavior, that is, the unitary constructs which likely jointly and possibly interactively are responsible for a given complex of behavior, this task cannot be accomplished by an analysis of complex behavior. After the units are known it should be possible (in theory at least) to predict complex behavior by way of a specification equation. It seems reasonable to assume that traits acting alone will likely affect simple behaviors. In terms of traditional test theory we seek variables which will discriminate traits.

If factorially complex variables are employed as tests in a factor analysis then by definition a poor simple structure will result[12].

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12 This may seem to be a tautologous statement but it should be remembered that certain investigators e.g., Guilford (1971) reject the principle of simple structure. Moreover other investigators begin by using variables which by their intrinsic complexity are likely to be factorially complex. Of course, it is not possible beforehand to determine precisely the complexity of a variable but to use composite variables e.g., (packages of items of dubious homogeneity) is to invite by their intrinsic complexity factorial complexity.

Not only will the variable load on several factors, but the loadings will be averaged (and consequently not distinct) over as many factors as are represented within the packages. This in turn will result in masking effects on "interpretation" since it will be difficult if not impossible to assess to which item within a package correlation with a factor is owed. Conversely, it is plausible on a priori grounds to expect single items to be factorially less complex, loading highly on one factor only with the consequent meaningful simple structure. Guilford (1952) in describing some common faults in factor analysis states: "Rotations and interpretations would be much simplified if each variable were of complexity one; that is, if it measured only one common factor to any appreciable extent. This is an ideal that we achieve in test construction only once in many attempts...It may make the difference between success or failure in achieving a solution that is acceptable" (Guilford, 1952, p. 27).

In this context in questionnaire type media the use of simple unambiguous items would appear to be ideal, as Eysenck states: "The building stones of a questionnaire are the items, and objectivity demands that factor analysis should begin at this level" (Eysenck & Eysenck, 1969, p.326).

It should be apparent at this point that if one discovers a simple structure among a comprehensive pool though not tautologous groups, of personality items this implies predictive power, i.e., factor logic is essentially

test logic. "The ideal situation in selecting tests for a battery of measurement and evaluation enterprises would be to have tests highly homogeneous within themselves and highly specific from one to another" (Horst, 1966, p.326).

This speaks for the development of personality inventories from factor analytic studies. In order to acquire normal test reliability it may be necessary to include even more redundancy among the items than was previously stipulated for the purposes of factor identification and interpretation but as Horst has pointed out such factors imply a scale in terms of factor scores.

> It is curious indeed that work on scaling theory and methodology and that on psychological measurement have not recognized the integration of these two techniques in the factor analytic techniques (Horst, 1968, p.90).

Thus factors derived from item-factor analysis, assuming comprehensive and redundant sampling of a domain can provide scales of unitary personality traits which are maximally homogeneous and as such will in general prove to be intuitively appealing by their psychological interpretability. Yet one of the prime contentions of this thesis is the unsatisfactory nature of current factor analytic inventories. Before discussing these per se, it is necessary to review certain factor analytic issues.

Some Factor Analytic Issues

Descriptive vs. Explanatory Factors

> A factorial analysis can be made for one of two purposes, namely; (a) to condense the test scores by expressing them in terms of a relatively small number of linearly independent factors or (b) to discover the underlying functional unities which operate to produce the test performances and to describe the individual differences eventually in terms of these distinguishable functions (Thurstone, 1947, p.503).

Thus Thurstone categorized "factors" as "descriptive" or "explanatory" presumedly implying the Principal Components model and the Common-Factor model respectively. It is clear that Thurstone viewed a distinction between description and explanation. Nevertheless, it is precisely the legitimacy of this distinction which was to be the subject matter of the hypothetical construct vs. intervening variable debate which began with the now classic paper by MacCorquodale and Meehl (1948) on that subject.

Essentially the entire debate appears in retrospect to be a reaction against "narrow empiricism" characterized as follows by Hempel.

> Any term in the vocabulary of empirical science is definable by means of observation terms; i.e., it is possible to carry out a rational reconstruction of the language of science in such a way that all primitive terms are observation terms and all other terms are defined by means of them. This veiw is characteristic of the earlier forms of positivism and

> empiricism, and we shall call it the narrower thesis of empiricism. According to it, any scientific statement however abstract, could be transformed, by virtue of the definition of its constituent technical terms...
> ...Despite its apparent plausibility, the narrower empiricist thesis does not stand up under closer scrutiny (Hempel, 1952, p. 23-24).

Rozeboom (1956) draws a clear distinction between intervening variables and hypothetical constructs. The former have meaning only in relation to their empirical antecedents whereas the latter are not analytically reducible to same.

> An intervening variable (transformation variable) is a variable which has been systematically "defined" in terms of its antecedents and is hence dependent upon the latter for its meaning (Rozeboom, 1956, p. 253).

and regarding hypothetical constructs:

> In the last section we considered those mediation variables which derive analytically from their antecedents. For the remainder, passage from antecedents to mediators must be made with less than logical certainty, and such variables we shall designate as inferred variables. Precisely because inferred variables are not analytically contained in their antecedents, it follows immediately that (a) the meaning, or ontological content, of the inferred variables is not reducible to its antecedents and (b) a certain degree of error must be expected in passage to the inferred variable from its antecedents (Rozeboom, 1956, p. 254-255).

The reason for exposing the above distinction is that it appears that Principal Components has largely been viewed as a model that can produce "only" intervening variables whereas the common-factor model yields hypothetical

constructs to which a formal ontological status is attached. This latter conceptualization places factors in Feigl's nomological net (Feigl & Scriven, 1956; Royce, 1963) attributing to them the status of genotypic determiners of covariation among phenotypic variates.

Factor analysis whether of the Component model or Common-Factor model (to be discussed later) is a method of empirically defining variables and as such does not in any sense constrain the theoretical parentage or the ideational content or extra meaning of a given construct. To the contrary it adds to its meaning by providing an empirical definition and a possible means of measurement. Moreover, it is likely that the added meaning of a factor will be a function of the adequacy of the initial sampling of the domain. That is to the extent that it can be held to be representative and predictive of other variables. Such factors are of course, despite the use of an exact model not reducible to their antecedents. In any case, philosophers of science must begin with empirical data and as will be pointed out, the model employed is relatively independent of the results obtained providing certain conditions are met.

Factor Analytic Model

Factor analysis is a generic term referring collectively to several different models for analyzing the components of variance of variables. In the psychometric tradition

three linear models have assumed particular prominence: (a) the Components model (Hotelling, 1933) (b) Common-Factor model (Thurstone, 1947) (c) the Image Analysis model (Guttman, 1953).

Mathematically the aim in all cases is the same i.e., the approximation of a data matrix with one of lower rank. In order to illustrate this consider the Common-Factor model.

$$Z = XF^{1} + U$$

Where $\underline{Z}$, of order N persons by $\underline{n}$ variables is the matrix of standardized manifest variables, $\underline{X}$, of order $\underline{N}$ persons, K common factors is the matrix of common-factor scores, again scaled to have zero mean and unit variance, $\underline{F}$ of order $\underline{n}$ x $\underline{K}$, is the primary factor pattern matrix, and $\underline{U}$ of order $\underline{N}$ x $\underline{n}$ is the matrix of unique parts (error plus specificity) of the variables.

Further let $\underline{C}$ of order $\underline{N}$ persons x $\underline{n}$ variables be the common parts of the variables where

$$C = Z - U$$

then

$$C = XF^{1}$$

Mathematically the aim is to reduce the rank of C such that the order of $\underline{K}$ (factors) is much less than $\underline{n}$ (variables) while reproducing as far as possible $\underline{C^{1}C}$. While in practice exact rank reduction is unlikely, (Guttman, 1956) given common factor data, experimentally independent but correlated, the order of $\underline{K}$ can be much less

than that of n and account for a large portion of the variance of C thereby providing a parsimonious description of Z

The difference between the three models can be viewed as a function of the variance which is analyzed. In the Common-Factor model depicted above the variance analyzed is the estimated common variance of the variables in the domain. The Image Analysis model which is an exact model analyzes the common variance among the variables in the sample (the squared multiple correlation). In this sense the Principal Components model can be viewed as employing communality estimates of unity in the domain.

Two papers, Macdonald (1970) and Harris (1962) have done a great deal towards clarifying the interrelationships among the models. Harris (1962) related each of the above models to the matrix $S^{-1}RS^{-1}$ where the diagonal matrix $S^2 = [\text{diag } (R^{-1})]^{-1}$. One of the implications is that if all of the variables have identical communalities then a Principal Components solution, an uniterated Common-Factor solution (using SMC's as communality estimates) and a Harris Image Factor solution of the same data will yield configurally invariant factor pattern matrices. This implies (Kaiser, 1970) that interpretation of the meaning of all factors in all cases should be identical.

Of course to the extent that the communalities of the variables <u>differ</u> some differences may be expected. With personality items in a large analysis if the variance of the communalities is not severe it should not affect in a substantial way the interpretation one places on factors derived

from Principal Components analysis, qua factors[13]. Again it is important to realize that the most serious distortion in relative communality will be due to inadequate sampling or failing to provide enough redundancy (and equal density) among the variables to determine their actual relative communality; all three models are equally susceptible to this type of more potent distortion.

Certainly there are good reasons for selecting the Components model over the iterated Common-Factor model. In the first instance the former is an exact model in which factor scores are linear combinations of variables consequently it is more tractible to problems of prediction while still providing a reasonably good estimate of the

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13 Indeed it is the relative difference in communality which could cause distortions, although factor scores, and thus loadings in the case of Principal Components will be slightly larger this does not appear to be very serious when n is large, witness the following personal communication, 1970, from Sir Cyril Burt to Dr. Howarth. To the question "How many variables (tests, or the like) are needed to render it permissible to substitute unities in the leading diagonal of the correlation matrix?" Burt's answer was that "it depends on the size of the observed correlation coefficients which the matrix contains. The influence of the two conditions may, I think, be most readily indicated as follows.

To clarify the tendencies involved, let us take the simplest case that can possibly be conceived. Consider a correlation table which, when communalities are inserted, becomes a matrix of rank one. And to simplify the algebra still further, let us substitute the average of the communalities instead of the actual values, so that all the factor loadings are identical and all the entries are identical. Let the factor loadings be designated $\bar{r}$; then the communalities will

factors which would have arisen from a common-factor analysis. Another reason is strictly expedient, namely, the size of the analysis implied by adequate sampling precludes the common factor model since it would involve exhorbitant computational costs.

The Image model combines the conceptual qualities of the Common-Factor model e.g., (only the common variance is analyzed) with computational superiority of the Components model. As with the Component model, the Image model is an exact model; scores are linear combinations

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all be equal to r^2 (I drop the bar). Then, when unities are inserted, the total for any one column will evidently be $1 + (n - 1)r^2$, and the grand total for the whole matrix will be $n[1 + (n - 1)r^2]$. Hence the factor loading for the first factor will be

$$\sqrt{\frac{1 + (n - 1)r^2}{n}}$$

the difference between the factor-variance contributed by any one test or variable will be

$$\frac{1 + (n - 1)r^2}{} - r^2 = \frac{1 - r^2}{n}$$

Thus, the discrepancy between the results obtained by the two procedures will vanish as either r^2 approaches unity or n approaches infinity. The actual size of the discrepancy will depend on the size both of r^2 and of n.

In this light, it is questionable whether the use of the highest correlation of a variable as a communality estimate when n is large will not, though large, error of estimate, be even more distorting than assuming all communalities to be equal e.g., unity-Sell's Demaree and Will (1968) in a matrix of 600 variables employed as a communality estimate the highest absolute r.

of the images of the observed variables. Thus the hoary problem of unknown communalities is circumvented and as Guttman (1953) has shown as the universe of variables in the domain is sampled more and more extensively the Image and the Common-Factor models become one. Also the Image model holds promise for reducing the effect of distribution effects (Kaiser, 1970) "Distribution effects decreases as the distributions become more alike, especially with respect to skewness. Therefore, it may be speculated that the images, being less skewed than the original items, will be less sensitive to the distribution effect" (Berge, 1972, p. 919). Clearly in the absence of a sampling algorithm iteration is a somewhat fictitious futile endeavor. In this light the following comment is heartening:

> ...one will see that many of the mathematical issues in the literature on factor analysis concern inconsequential problems for empirical research and that some of the most important problems for empirical research frequently are subverted by Rube Goldberg mathematical developments (Nunnally, 1965, p. 290).

It is concluded that with respect to factors derived from personality items, they can be expected to be robust across the models discussed above providing the variance of the communalities is not severe. This however cannot be said of the choice of the rationale adopted regarding the number of factors to retain for transformation.

Number of Factors Problem

> There is probably no facet of the factor analytic process that appears more arbitrary or intractable than that concerned with determining the "correct" number of factors to represent the variables at hand. A unique solution is indeed not theoretically possible in that the decision reached regarding the "true" dimensionality of a domain of variables depends entirely upon which one of a number of seemingly reasonable operationalizations of the "number of factors is employed" (Hakstian & Muller, 1973, in press).

It is beyond the scope of this paper to present more than a cursory examination of the problem and the various rationales as thoroughly discussed by Hakstian et al. (1973).

In search of an objective rationale which could lead to unequivocal results as to how many factors to extract for transformation four classes of criteria have been listed by Kaiser (1961).

1. Algebraic criteria, determining upper and lower bounds on the rank of the matrices involved. With respect to Harris Image factors, Guttman's strongest lower bound corresponds to those factors associated with roots greater than one. In terms of Common-Factor analysis this criteria implies the number of roots of $R - U^2$ greater than zero. It indicates the largest number of factors, typically six tenth's as many factors as variables. As an aside Guttman (1954) also proves that the number of factors problem cannot be resolved.

2. Psychometric criteria dealing with the internal

consistency of the constructs obtained. The widely used Kaiser-Guttman rule of roots greater than one of R falls into this class. This has been criticized by Hakstian et al. (1973) since roots less than one before transformation may have positive generalizability after transformation and they argue that this class of criteria, if applied at all should be applied after rotation (i.e., to SSCLs greater than unity).

3. Statistical criteria involved with reproducing the observed correlation matrix to a tolerance level ascribable to sampling error. This class is not wholly objective since the tolerance level which is selected contains a subjective element. Furthermore, it is at odds with the psychometric tradition in which variables and not persons are sampled. This approach is dependent upon total sample size with "statistical but not practical significance" when N is large.

4. A fourth class is concerned with the importance or interpretability of the factors obtained. The procedure adopted in this study is Kaiser's (1963) rule of "rotation for residualization" about which Hakstian et al. have said:

> We are left the image analysis-based "rotation for residualization" procedure is perhaps closest to the most fruitful operationalization of this rationale (Hakstian et al., 1973) -i.e., importance rationale.

Essentially Kaiser suggests:

1. rotate all Harris factors associated with roots greater than one i.e., Guttman's stronger lower bound,

orthogonally e.g., (Varimax).

2. Determine those factors which are likely to be of psychological interest, e.g., proceed until essentially a null vector is observed (my interpretation).

3. Rerotate only that number of factors using Harris (1964) orthoblique or other adequate simple structure criteria (again my interpretation).

This procedure appears to have much to recommend it. While it recognizes that the dimensionality of the system is at least as great as that indicated by Guttman's strongest lower bound, it appears to present a reasonable safeguard against over factoring and its associated risk of fissioning otherwise relatively unitary constructs.

This procedure would in addition be compatible with a conclusion reached by Hakstian et al.[14]

> The implication here is that the decision regarding the number of factors perhaps most profitably can be made <u>after</u>, rather than before transformation. The use of Guttman's stronger lower bound may be most appropriate, with successively fewer factors transformed until a most interpretable solution results (Hakstian, et al., 1973).

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14 This is basically an interpretability criterion which Howarth has been using since 1968--also used by Parker and Veldman (1969). It might be emphasized that in the absence of a good simple structure it is difficult to apply the rule, this perhaps partially accounts for the search which has generated so many conflicting rules of thumb.

Measure of Association

The classical aim of factor analysis is to determine the latent structural relationships among a set of manifest variables sampled from a given domain. A corollary of this position is that the chosen measure of association should reflect "only" the underlying latent relationships and not be distorted by the manifest relationships between the variables. According to Carroll (1961) this is sufficient theoretical justification for the use of the tetrachoric coefficient when the data have been artificially dichotomized and should be preferred over phi-coefficients. Another position to consider however, is that "the analysis and interpretation of the data for the purposes of prediction are the ultimate objectives of science and that without these the data are largely useless" (Horst, 1966, p. 3).

In this light it is reasonable to enquire how much distortion can be expected as a function of using phi and secondly one must decide if that amount of distortion means that it is worthwhile to sacrifice the regression-prediction qualities of phi. Several methodologists e.g., Carroll (1945, 1961); Ferguson (1941); Wherry & Gaylord (1948) and Fruchter (1954) maintain that tetrachoric r's are to be preferred. For example Fruchter unequivocally states: "The phi coefficient (fourfold point correlation) should not be used unless some correction is made to avoid spurious factors due to differences in splits of the dichotomized variables" (Fruchter, 1954, p. 201).

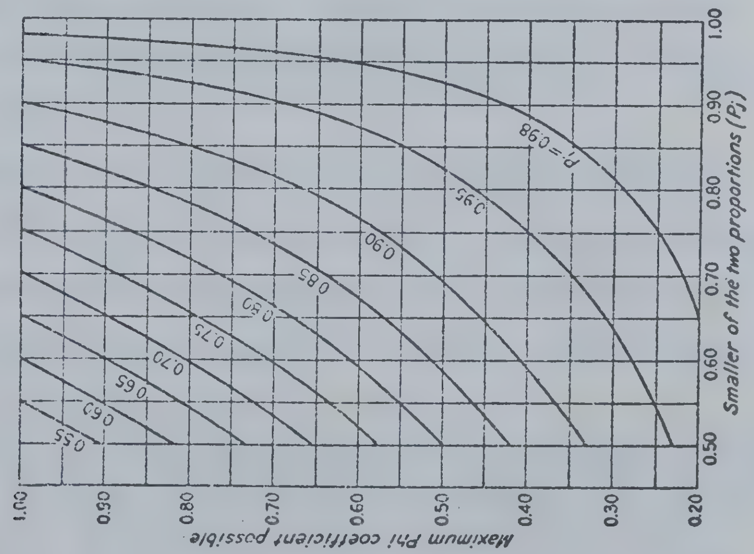
It should be pointed out that these recommendations were largely intended for intelligence data. With personality items several investigators who have examined the issue e.g., Dingman (1958), Borgatta (1965) would agree with Comrey and Levonian (1958) that "the phi coefficient is the method of choice in point correlation work where factor analysis is to follow" (Comrey et al, 1958, p. 752). Thus it may be possible to reconcile these two apparently opposed positions.

$$\text{Phi} = ad - bc / \sqrt{(a+b)\ (a+c)\ (b+d)\ (c+d)}$$

where a, b, c, d, represent joint frequencies of pass-fail (yes-no) for two items in a four point contingency table.

It can be shown that as the ratio b/c to a/d becomes disparate a maximum less than ±1 is imposed on the value phi can assume. This "restriction in range" is exponentially related to the degree of disparity as indicated in Fig. 2 taken from Guilford (1965, p. 315).

Figure 2



Thus, a correlation between any two items will be a function of both the content of the item and their means. In analyzing a matrix in which the means differ factors will be required to account for the content as well as the variance caused by the means. Berge (1972) maintains that what has traditionally been referred to as difficulty factors should be called "distribution factors" since they arise in pure form when "items given their p values have as high a correlation as possible" (p. 914). Berge (1972) emphasized that the phenomena is a function of differences in skewness of distributions, and that all Pearson PM coefficients are susceptible though not as sensitive as Phi. This in his view does not in itself prohibit factoring binary (phi) data of differing skew. "This because most binary items used by psychologists correlate far below the ceiling values imposed by distribution shape discrepancy. Consequently, it most cases one will easily accept distribution shape discrepancy as an indication of non-equivalence of items" (Berge, p. 918).

It appears that although some distortion can be expected, particularly among relatively homogeneous items, phi coefficients will not produce severe distortions when the correlations are not large[15]. Carroll (1961) compared

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15 However, it should be pointed out in relation to the present study, that Dr. Howarth selected the original items as (among other criteria) being relatively free of bias. The reason for this was that, although preceding studies (HPQ, HPQ_2) had failed to reveal "difficulty factors", or indeed to relate factor

phi and tetrachorics and noted:

> It can be seen that as the value of the tetrachoric r increases, the boost from the Pearsonian value becomes more and more dependent upon the discrepancies of the marginal distributions as measured...inadequately to be sure...by the differences in their skewnesses. The differences are, in fact, not at all large until the size of the latent relationship as estimated by the tetrachoric r...becomes appreciable (e.g., greater than .50) (Carroll, 1961, p. 365).

Thus the difference between the coefficients is a function of the extent of the relationship and secondly the disparity of item means. However, part of that difference with highly disparate means should be allowed in favor of phi.

> A second reason for not employing... r tetrachloric is that, even if it were sensible to make such estimates of the PM coefficient between two continuous variables, they are frequently very poor estimates...When the assumption of normality is not met, the estimates can be off by more than 20 points of correlation...The errors of estimate frequently found with these coefficients show that they should generally not be employed (Nunnally, 1965, p. 124).

Also, it should be pointed out that a comparison of phi, phi-over-phi-max and cosine-pi approximation to tetrachoric r with MMPI items led Comrey and Levonian (1958) to conclude:

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structure and item bias, in any perceptible way, Dr. Howarth still wished to avoid item bias, not only in combined, but in separate male and female samples. This was not only to avoid possible "difficulty factors" or criticisms from psychometrists who have been steeped in the intelligence testing approach--but also (a) to avoid sex factors (b) to try to avoid specific sample factors, and thereby (c) to produce replicable factors across samples (e.g., differing in sex, age, intelligence).

> Results of this investigation showed that the allegedly identical factors from separate previous analyses were in fact different despite certain similarity upon visual inspection. Results from the three different methods were very similar with respect to the main factors however. Furthermore, the phi coefficient was relatively free of excessively high communalities which seemed to be present in the phi-over-phi max and tetrachoric analyses. It is concluded that in certain cases the phi coefficient is much better for factor analytic work than is generally believed (p. 754).

Secondly, if the majority of correlations are small, with a small percentage of relatively large correlations, which is the nature of common-factor data, we can expect that the large correlations will be smaller relative to the near zero correlations but still large enough to show a strong simple structure. It appears that this is the case with personality items in general. In the Sells et al. (1968) study a distribution of correlation coefficients was computed (Pearson product-moment correlations of trichotomously scored items) among 600 items and 2011 subjects[16].

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16 Dr. Howarth has histogrammed a random set from over 80,000 COS phi coefficients. Very few correlations exceed .20. With a sample of 1003 _Ss_ a correlation of .10 is significant (P<.01).

Range of Correlation Coefficient	Percentage Distribution
> .29	.5
.25 - .29	.9
.20 - .24	2.4
.15 - .19	5.9
.10 - .14	14.0
.05 - .09	30.7
.00 - .04	45.6
	100

It is possible to determine (Berge, 1972) whether a given matrix is dominated by distribution effect. In such a case, each principle axis factor can be represented as simple functions of the item p-values (e.g., the loading on the first factor will be a first moment function of p-value i.e., a bell shaped function, with a maximum in the region of the median p-value).

It would thus appear subject to the above that phi coefficients should be preferred to tetrachoric with personality items, this may not be the case with intelligence items which are reputed to be generally highly intercorrelated.

In any case further research involving a parametric investigation of the sources of distortion with phi, vis-à-vis tetrachoric coefficients is indicated. It is also probable now that some of the traditional reasons for using phi are no longer tenable, (e.g., ease of data processing, ease of computing) that phi should be re-evaluated in relation to regular PM coefficients, since these are known to yield higher correlations hence less error variance.

Social Desirability

Unlike distribution effects, item difficulty in the case of intelligence items or item preference with personality items as termed by Horst (1965) can be accounted for in terms of one factor (Berge, 1972).

In factoring intelligence data there generally results what is termed a "g" factor, interpreted as a capacity for solving difficult tasks. That is, on this (here hypothetical) bipolar "g" factor, which is generally the first unrotated principal axis factor in an analysis, (since all items above) and below the median difficulty contribute to its variance), we find that the more difficult the test the higher the loading (correlation) on the factor and vice-versa; also that the median values load near zero. If the loadings were plotted, (loadings on the ordinate, means of items along the abscissa) a U-shape plot would result.

The personality factor analogue of our hypothetical "g" can be termed "p" for preference value of an item as termed by Horst (1965). In such a case, a perfect "p" factor, would correlate near perfectly with the item means. Additionally, if it were found that the item means were in turn highly correlated with social desirability ratings of the items, we could then infer a "tendency among individuals to give socially desirable (SD) responses regardless of content". Such responding has been termed SD responding by Edwards (1957, 1970). Edwards (1970, chpt. 17) has described a factor analysis (Components model) in which a

relatively pure form of "p" has been observed, in terms of the first unrotated principal component.

In this study 90 trait terms were first rated on a nine point scale for social desirability (SD) by a group of 214 judges (male and female) and subsequently the trait list (requiring either a true or false response) was administered to 307 Ss. Phi coefficients were computed between the 90 trait terms and factored by way of Principal Components. Results of the study found (a) PM correlation between percentage answering trait true (PT) and SD value of .92 (b) PM correlation between trait SD value and first principal component of .90. Thus, we can assume a very strong relationship between PT and first factor loadings. Thus according to the definition above, we have a fairly clear example of a "p" factor. Edwards (p. 244) interprets the first principal component as a Social Desirability-Social Undesirability factor.

With this interpretation, the present experimenter cannot agree, for example in order to have a low score on this factor, one would have to attribute to himself several of the following traits: fanatical, inflexible, conceited, stingy, artificial, immoral, nosy, rude and stupid. The dominant characteristic of these traits is that they are extreme and they indicate severe maladjustment. The fact that they do not occupy a position as a component of adjustment is simply that in the analysis described above, the domain was not sampled so as to include normal range items of adjustment; this of course can lead to

mis-interpretation. This hypothesis is of course subject to verification and this study affords that opportunity.

Review of Guilford and Cattell Factors

Four large recent studies, (Sells, Demaree & Will, 1968; Eysenck & Eysenck, 1969; Howarth & Browne, 1971a; Jernigan & Demaree, 1971) have indicated the extent of factorial complexity in existing purportedly empirical factors of personality. <u>In each of these independent researches it was observed that although source factor heterogeneous with respect to the "trait system" being tested, the empirical factors derived were content homogeneous</u> i.e., the salient item aggregate on any factor was psychologically meaningful and interpretable. Let us now turn to the details provided by these studies in support of this generalization.

<u>Sells, Demaree & Will (1968)</u>

In this study 300 items submitted by Guilford as markers for 15 Guilford factors (GAMIN, STDRC, O, Ag, Co, AA, CC) together with 300 items submitted by Cattell as markers for 17 Cattell "factors"[17] (A, C, D, E, F, G, H, I,

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17 The term "factor" in relation to putative factors assembled piecemeal by packages or by intuition will not hereafter be placed in quotes, despite the widely quoted work (e.g., in textbooks such as Tyler, 1965) of these authors. However, the unsatisfactory nature of these "factors" is one of the prime concerns of the present thesis.

L, M, N, O, Q_1, Q_2, Q_3, Q_4)[18] were administered to 2011 airmen at Lackland Air Force Base, Texas in 1966.

The matrix of product moment correlation coefficients was factor analyzed by the principal axis method using the highest correlation for each variable in the array as a

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18 The labels of Guilford factors are:

G - General Activity
A - Ascendence vs. Submissiveness
M - Masculinity
I - Inferiority vs. Confidence
N - Nervousness vs. Composure
S - Sociability
T - Thoughtfulness
D - Depression
C - Cycloid Personality
R - Rathymia
O - Objectivity
Ag - Friendliness
Co - Cooperativeness
AA - Artistic Interest
CC - Cultural Conformity

The labels of Cattell factors are:

A - Sizothymia vs. Cyclothymia
C - Ego Strength
D - Excitability
E - Submissive vs. Dominant
F - Desurgency vs. Surgency
G - Superego Strength
H - Threctia vs. Parmia
I - Harria vs. Premsia
J - Coasthenia vs. Zeppia
L - Alaxia vs. Protention
M - Praxernia vs. Autia
N - Artlessness vs. Shrewdness
O - Untroubled Adequacy vs. Guilt proneness
Q_1 - Conservatism vs. Radicalism
Q_2 - Group Adherence vs. Self-Sufficiency
Q_3 - Casual vs. Controlled
Q_4 - Ergic Tension

communality estimate. Although 23 factors were extracted the basis for interpretation was an 18 factor Promax solution. Of these 18[19], 11 were found to be interpretable and were labelled: (1) Emotional stability, (2) Social Extraversion, (3) Artistic Interest, (4) Conscientiousness, (5) Cyclothymia vs. Schizothymia, (6) Agreeableness vs. Hostility, (7) Relaxed Composure vs. Suspicious Excitability, (8) Personal Relations, (9) General Activity, (10) Radicalism vs. Conservatism, (11) Considerateness vs. Aggressive disregard for others. The salients greater than $\pm.30$ on one Sell's factor are shown in order to provide an evaluation of the factors of Guilford and Cattell (here represented by "markers").

Factor 4 "Conscientiousness"

(see p. 159, Sells, Demaree & Will, 1971)

G - Guilford
C - Cattell

Source Factor	Item	Loading
M (G)	I am disgusted at the sound of foul language.	.78
E (C)	The use of foul language even when it is not with mixed groups of men and women, still disgusts me.	.71

19 With an oblique (pattern on primary) solution it may be inadvisable to consider loadings of less than .40. However, the "rules" of small scale F.A. do not necessarily apply to large scale F.A., as shown by the consistency of these items down to weights of .30.

G (C)	I think people should observe moral laws more strictly than they do.	-.57
CC (G)	The surest way to a peaceful world is to improve people's morals.	.52
CC (G)	What this country needs most are higher standards of conduct.	-.51
M (C)	I wish society would demand (a) stricter observance of the Sabbath (b) uncertain (c) a greater freedom in regard to divorce.	.51
G (C)	If my income were more than enough for ordinary daily needs, I would feel I should give the rest to a church or otherwise worthwhile causes.	-.51
CC (G)	I am uncomfortable and embarrassed when I see someone break accepted rules of good conduct.	-.48
M (G)	I am disgusted at the sight of an unshaven man.	.48
E (C)	I'd be extremely embarrassed to tell people I spent my vacation at a nudist camp.	.44
CC (G)	My parent's ideas of right and wrong always proved to be best.	-.43
EG (C)	When telling a person a deliberate lie, I am ashamed to look him in the eye, and have to look away.	.41
CC (G)	Very strict home discipline would prevent much of the crime in our society.	-.41
G (C)	I value good manners and respect for rules, more than easy living.	-.41
G (C)	I am a fairly strict person, insisting on always doing things as correctly as possible.	-.39
G (C)	I greatly dislike the sight of disorder.	.38
G (C)	I always make a point, in deciding anything, to refer to the basic rules of right and wrong.	-.37

A (C)	I admire my parents in all important matters.	-.36
M (G)	The sight of pus disgusts me.	.36
M (G)	I am disgusted at the sight of ragged or soiled fingernails.	.35
CC (G)	Good rules of etiquette are very important.	-.34
A (C)	I would prefer the life of (a) an artist (b) uncertain (c) a secretary running a social club.	-.33
F (C)	I avoid any embarrassing sexual topic in talking with members of the opposite sex.	.33
Q_4 (C)	I dislike seeing religious authority overturned by so-called progress and logical reasoning.	.33
N (C)	I would rather mix with polite people than rough rebellious individuals.	.32
CC (G)	Unless everyone recognizes his duty to society, civilization is doomed.	-.31
I (C)	I would prefer to have (a) more money (b) uncertain (c) more time for thinking about life.	-.31
G (C)	I enjoy giving my best time and energy to my friends rather than to social activities and personal hobbies.	-.31
I (C)	I would rather be a bishop than a colonel.	-.30
N (C)	I think it is more important in the modern world to solve: (a) the political difficulties (b) uncertain (c) the question of moral purpose.	.30

This factor has been interpreted by Sells, et al. (1968) as "Conscientiousness" which they describe as "intrinsic to the ideas of religious, moral standards and observance, use of discipline, propriety, respect for authority, conformity with social norms, rules and niceties, respect for hard work

and serious thinking" (p. 98).

Inspection of the salients reveals that Cattell source factors A, E, F, G, I, M, N and Q_4 are represented by 2, 3, 1, 7, 2, 1, 2 and 1 marker items[20] respectively. Two Guilford factors are present M (4 markers) and CC (7 markers). A chart reproduced from Sells et al. (1968) is included in Appendix II which graphically illustrates the generality of this phenomenon, i.e., the tendency of the item aggregate of a putative source factor to disintegrate and for the item to relocate to form empirical factors which appear to be homogeneous in content.

Adopting the marginal[21] saliency criteria of .20 it is interesting to note that of the markers submitted by

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20 i.e., submitted by Dr. Cattell to Dr. Sells as marker items for Cattell factors.

21 It may occur that a loading of .20 is very significant, however, when loadings on a factor are as large as .78 as in factor 4 (Sells et al., 1968) .20 becomes rather insignificant. In terms of variance the factor can be viewed as accounting for 60% and a mere 4% of the variance of an item respectively. Three other considerations in determining what is a significant loading are: (a) the model used, e.g., Component loadings must be larger to be as significant as Image loadings (b) the complexity of an item and (c) whether it is derived from an orthogonal or oblique solution, if one insists on orthogonal structure lower loadings may indeed be significant. In the case of this fourth factor, which had an eigenvalue of about 10 (although the actual SSCL after rotation would be required) the average loading (or weight) over all 600 items would be only .0166. It is in relation to this that acceptance of saliency values should be considered, hence the usual 'rules' for small F.A. (i.e., use of .40/.35 in oblique/orthogonal) do not necessarily apply.

Cattell for 17 Cattell factors only three factors A, G, and F were successful in retaining 50% of their representative items with their largest loading on any single empirical factor. In this respect Guilford fared better, but not impressively. G, N, S, D, C, Co, AA and CC retained 10/14, 16/19, 16/19, 10/14, 16/21, 17/32, 20/20 and 12/25 markers respectively. The other Guilford source factors A, M, I, T, R, O and Ag however, underwent a more serious disintegration. The fact that AA for example maintained complete factorial integrity is a significant fact about which the authors said "...the conveyence of all 20 Guilford AA items as unique markers for factor T_3... demonstrates that this heterogeneity should not be dismissed as an anomalous result. On the contrary, it reflects the overlapping item composition of the majority of source factors, which has apparently gone unchallenged for many years" (Sells, et al., 1971, p. 419).

Thus the authors summarize the study in the following fashion:

> The correlations among items in the present study and the rotated factor results derived from them, have demonstrated beyond question that analysis at the item level is highly destructive to the factors previously assembled without adequate concern for their loadings in large matrices in which a wide range of factors is known to exist...
>
> The results indicate a clear need for reclassification of at least 400 of the 600 source items with respect to the factors for which they were represented as markers for inclusion in the present study. They lend strong support to the

> belief that further progress in personality measurement must begin with the refinement and improvement of the item pools (Sells, et al., 1971, p. 421).

Fortunately[22], this compelling evidence indicating a need for comprehensive item-factor-analysis is not uncorroborated as is illustrated by the following analysis of Cattell's 16 PF Questionnaire.

Howarth & Browne (1971a)

In this study the 16 PF (1970) which is purported to measure 16 personality traits at the primary level was administered to 567 subjects (316 females, 261 males) at the University of Alberta.

The correlation matrix derived from this data consisted of Pearson product-moment correlations, except for the B (intelligence) scale, which was scored dichotomously and resulted in biserial coefficients wherever these items are related to the other items. Factoring was by the method of principal axis using the method of Householder-Ortega-Wilkinson. Since the 16 PF was designed for 16 factors, 18 factors were initially extracted, however when rotated to orthogonal simple structure only "10 factors proved to be interpretable". Adopting the "criterion of psychological

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22 Naturally the work of one group of investigators, even on such a large scale (600 variables, 2011 subjects) is not, on its own, going to cast down the supposedly established systems of Guilford and Cattell, in view of their wide currency, both in use, and in textbook references.

interpretability" to determine the number of factors, the authors considered this an over-extraction and proceeded to a 12 factor solution, then to a final 10 factor Varimax solution for which the salients were reported. These factors were labelled: (1) Adjustment-emotionality, (2) Radicalism, (3) Sociability, (4) Tough vs. Tender-minded, (5) Cooperativeness-Considerateness, (6) Impulsiveness, (7) Dominance, (8) Social Shyness, (9) Physical Prowess, (10) Rhathymia.

Factor 2, Radicalism appears to be similar in some respects to the factor previously discussed under the label "Conscientiousness" figuring in the Sells, et al. (1968) study. For comparison the salient items loadings (±.35)[23] on this factor are shown below (labelling on left shows Cattell's factor ascriptions).

Radicalism (Possibly Superego (SG))

Factor in 16 PF	Item	Loading
G	I think that plenty of freedom is more important than good manners and respect for the law.	-.58
G	I think the police can be trusted not to ill-treat innocent people.	.51
Q_1	I am considered a liberal "dreamer" of new ways rather than a practical follower of well-tried ways.	-.47

23 In this study the rule of accepting salients greater than .35 was followed. With an eigenvalue of about 5.5 and with 184 variables, each on the average, contributed .025 (approximately).

Q_3	I like to go my own way instead of acting on approved ways.	-.44
M	I like a friend (of my sex) who seriously thinks out his attitudes to life: (vs. efficient and practical in his interests).	.42
N	I would rather mix with polite people than rough rebellious individuals.	.35
C	I admire my parents in all important matters.	.35

Thus, among the top seven salients six source factors are represented. Again this is not an anomalous result but rather an illustration of my generalization.

In an item analysis based on the same correlation matrix,[24] Howarth, Browne & Marceau (1972) found that the average item within a Cattell source factor correlated significantly with 1.89 other items <u>within</u> its factor and 15.86 items <u>outside</u> its factor. It was further observed that the mean percentage of significant correlations of the total number possible within a given Cattell "scale" was 33.4%. What is even more devastating is the inconsistency of the "scales" in this respect. B(intelligence) for example realized 11 out of 78 possible significant intra-factor correlations whereas H (Parmia vs. Threctia) (really Social Shyness) realized a wholesome 60/78 significant intra-factor correlations. On the other hand, Howarth, Browne & Marceau

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24 The calculations for this, which involved the inspection of about 18,000 correlations, were mainly carried out by the writer of the present thesis, the data having previously been obtained and processed by Dr. Howarth in 1969/70.

(1972) found that the empirical factors derived from an item-factor-analysis of the 16 PF realized among the salients (±.30) a mean intra-factor correlation of 78.3%.

Eysenck & Eysenck (1969)

Eysenck & Eysenck (1969) separately factor analyzed 99 Cattell items, 109 Guilford items and 114 Eysenck items with corroborative results with respect to Cattell and Guilford factors.

> Little comment is required; the figures speak for themselves. There is very little support in these factors for the picture of personality structure which Cattell has presented at the first-order level of description, in every case, two three or more of Cattell's factors are mixed together to give rise to one of our factors (Eysenck & Eysenck, 1969, p. 225).

Since the point that is being pressed here is the need for the level of analysis to proceed at the item level the following statement by Eysenck assumes particular significance.

> The outstanding fact about such systems as those of Cattell and Guilford is not that they are objective, and based on correlation and factor analysis, but that they are subjective and based on arbitrary and intuitive judgements. The building stones of a questionnaire are the items, and objectivity demands that factor analysis should begin at this level, i.e., with the intercorrelation and factor analysis of items. Yet this has in fact not been done; although Guilford, for instance, began by establishing factors on the basis of small-scale factor analyses of some 20 or 30 items, he constructed his inventories on the basis of adding to these items others not selected on the basis of factor analysis, but by intuition

> and hypothesis. At no time did either he or Cattell intercorrelate all the items in his scales in one single analysis, to establish the fact that the postulated factors did in fact exist, and emerge with the correct items having high loadings on these and only these factors (Eysenck & Eysenck, 1969, p. 326-327).

Jernigan & Demaree (1971)

In a recent item-factor-analysis of the Guilford Zimmerman Temperament Survey (GZTS), Jernigan & Demaree (1971) concluded: "It is clear from the results of this item-factor-analysis that at least 10 fairly distinct factors underlie the GZTS. The results of the solution based on the rotation of 14 Varimax factors indicates that there are 13 well defined and content homogeneous factors. The factorial validity of the 10 GZTS traits was NOT confirmed by the results of either solution" (Jernigan & Demaree, 1971, p. 112).

The factors found in this analysis (10 factor varimax solution) together with the four highest salients of each factor were:

(1) General Activity

Marker for Guilford factor		Loading
G 81	You like to do things slowly and deliberately	-.60
G 116	You are slow and deliberate in movement.	-.59

G 96	You get things done in a hurry.	.58
G 31	You work more slowly and deliberately than most people of your sex and age.	-.55

(2) Industriousness

G 131	Others are often amazed by the amount of work you turn out.	.46
G 111	People sometimes tell you to slow down or take it easy.	.45
R 62	Many of your friends think you take your work too seriously.	.40
G 46	People think you are a very energetic person.	.39

(3) Outspoken in Defense of Rights

297 F	If anyone steps ahead of you in line, he is likely to hear from you about it.	.52
58 A	When a clerk in a store waits on others who should come after you, you call his attention to the fact.	.50
182 F	You hesitate to tell people to mind their own business.	-.49
242 F	When you resent the actions of anyone, you promptly tell him so.	.43

(4) Inuredness

32 R	You are a carefree individual.	.48
115 E	Disappointments affect you so little that you seldom think about them twice.	.47
82 R	You are a happy-go-lucky individual.	.46
90 E	You seldom give your past mistakes a second thought.	.45

(5) Thoughtfulness

258 T	You enjoy analyzing your own thoughts and feelings.	.59
278 T	You are inclined to be introspective, that is to analyze yourself.	.59
218 T	You often take time out just to meditate about things.	.57
92 R	You often stop to analyze your thoughts and feelings.	.51

(6) Desire to Dominate

172 F	You hate to lose an argument even when the issue is not very important.	.49
197 F	In group undertakings you almost always feel that your own plans are best.	.40
136 G	It irritates you to have to wait at a crossing for a long freight train to pass.	.39
167 F	You hate to lose in a contest.	.36

(7) Squeamishness

255 M	The sight of large bugs and spiders gives you a "creepy" feeling.	.44
180 M	The idea of finding a bug or a worm crawling on you makes you shudder.	-.41
245 M	You can handle a loaded gun without feeling at all jittery.	-.38
235 M	The sight of ragged or soiled finger nails is repulsive to you.	-.37

(8) Emotional Stability

145 E	You sometimes feel listless or tired for no good reason.	-.59
15 E	You sometimes feel "just miserable" for no good reason at all.	-.57
55 E	You have frequent ups and downs in mood, sometimes with and sometimes without apparent cause.	-.57
75 E	Your mood often changes from happiness to sadness, or vice-versa, without your knowing why.	-.53

(9) Sociability

89 S	You are inclined to limit your acquaintances to a select few.	-.58
74 S	You have difficulty in making new friends.	-.56
14 S	You like to take part in many social activities.	.55
44 S	You find it easy to start conversation with strangers.	.54

(10) Personal Relations

274 P	Most people are out to get more than they give.	-.57
199 P	Most people today try to do an honest day's work, for a day's pay.	.48
259 P	Most people use politeness to cover up what is really "cut-throat" competition.	-.45

It is important to note that although Guilford began with item-factor-analysis, (Guilford & Guilford, 1934, 1936, 1939a, 1939b) and employed others (Layman, 1938; Mosier, 1937) as the basis for his Questionnaires (STDCR, GAMIN and GZTS), that, "in the development new items were written for each

factor. These and the old ones, were put through the process of internal-consistency item analysis to form pools of items with scoring weights, to develop a measuring scale for each factor, primary trait, or primary dimension of personality" (Guilford & Zimmerman, 1956, p. 22)[25].

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25 This article represents Guilford's last empirical involvement with personality items, and the factor structure therein Unfortunately, the computer facility of that time (see Howarth, 1972) did not permit of item factoring all of the items of Guilford factors (GAMIN, STDCR, O, Ag, Co). As an approximation Guilford proceeded by way of package analysis. "By inspection of content and from consideration of relevant, previous statistical information, we combined items into small, homogeneous groups. Two investigators independently categorized the items for each factor, then, after discussion eliminated any items on which there was disagreement". Seventy packages it must be emphasized--the homogeneity of which is open to question, were obtained.

These seventy packages, 5 or 6 per hypothesized factor, were intercorrelated and factorized (centroid method) and graphically rotated to an orthogonal simple structure. If the packages as discussed earlier are not in fact relatively homogeneous, we can expect, (a) that the loadings of the packages will not be much greater than the loadings of single items in general and (b) that such packages will be factorially complex thus loading on several factors.

The homogeneity of the packages is thrust into serious doubt when one considers that only 10 packages loaded in excess of .60 in this solution A result one would expect with items but not with homogeneous packages, whose reliability would be much greater.

Secondly, considerable factorial complexity was found--the factor analytic corrollary of non-homogeneity of packages.

To illustrate the extent of complexity of the packages, the loadings greater than $\pm .30$ on an empirical factor considered by Guilford & Zimmerman to be a replication of Inferiority (I) are given together with their loadings >.30 on other factors.

To recapitulate, studies by Sells, et al. (1968); Howarth & Browne, (1971a); Eysenck & Eysenck (1969) and Jernigan & Demaree (1971) have unequivocally demonstrated that "factor scales" previously assembled by means other than item-factor-analysis, had a strong tendency to disintegrate and relocate to form empirical factors which were homogeneous in content[26] and consequently meaningful psychologically.

Package	Loading	Loadings on other factors		
21	.64			
55	-.52	(0 - .31)		(Co- .37)
29	.46	(0 .33)	(S .43)	
19	.45	(0 .30)	(G .34)	
17	.44		(G .44)	
20	-.43			
10	-.43			(A - .40)
6	.41			(A .49)
57	-.35	(0 - .54)		
18	.34	(0 .30)	(G .38)	
42	-.34			(C_2 .32)
23	-.33		(N - .42)	
67	-.32		(C_o- .62)	(Ag- .45)
46	-.31			(C_1 .43)
22	-.30	(0 - .30)	(N - .40)	

(Guilford & Zimmerman, 1956, p. 12) Thus, this study can be seen to raise suspicions which were confirmed by Jernigan & Demaree (1971).

26 It is interesting to note in this respect that the variables of content homogeneous factors would afford of item recapture (c.f. Meehl, Lykken, Schofield & Tellegen (1971), Recaptured-Item Technique). Meehl et al. stress the importance of being able to arrive at a consensus regarding the meaning of a factor, e.g., they argue: "that one consideration worthy of attention in evaluating a proposed analytical solution to the rotation problem is its long-run tendency, over a substantial number of studies and diverse behavior domains, to facilitate the interpretative process in the direction of increased inter-subjective communicability, this being one of the general demands that science makes upon any research procedure (p. 187).

To the extent that these empirical results can be construed as confirmation that prior packaging of items merely obfuscates interpretation and prejudices the analysis whereas subsequent scale construction by "internal consistency methods" results in factorially complex scales, then, to that extent it is submitted these respective methods are inaccurate and conceivably can account for a great deal of the lack of consensus among so-called "factored trait systems".

Indeed, according to the criterion of factorial validity adopted here, Cattell and Guilford factors with few exceptions do not even meet the first requirement of replicability.

Review of Eysenck Factors

It is important to note firstly that Eysenck is not operating within the psychometric tradition; his object is not to map the structure among the variables of the domain of personality. Clearly Eysenck is operating within a bivariate scheme; as such Eysenck seeks support in the questionnaire media for the univocality of Introversion-Extroversion and Neuroticism[27].

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27 Earlier work by Guilford (1934, 1936, 1939a, 1939b) had stressed the multivariate nature of "extraversion", just as that by Mosier (1939) had revealed the multivariate nature of "anxiety".

> It is because we can deduce the existence of E and N, and their relationships, from these more fundamental and general theories that we lay stress on the factorial findings supporting our general position, not vice versa;...(Eysenck & Eysenck, 1969, p. 169).

Eysenck contends that primary factors are not in general replicable;[28] "this is true even when the instruments used are identical. When they differ then the outcome tends to be one of uttermost confusion" (Eysenck, 1967, p. 41). In this context it is noteworthy to compare the labels attached to primary factors derived from three separate analyses of items from different forms of the Eysenck Personality Inventory (EPI).

Study A

This study is reported in Eysenck & Eysenck (1969, p. 155-165). In this study 108 EPI items were administered to 500 Ss, half males and half females; phi coefficients were computed and the matrix analyzed by the principal axis method (Components model i.e., unities in the leading diagonals) thirty-three factors were extracted (latent roots greater than unity rationale) and rotated to orthogonal simple structure (Varimax). Thirteen of the first fourteen Varimax factors were interpreted and labelled

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28 In a personal communication to Dr. Howarth, Eysenck claims that some of the tail factors are tautologous, and are replicated only because of this. This view of Eysenck has been overridden by later work as will become apparent as the etiology of the HPQ is discussed.

as follows: (1) Mood-Swings, (2) Sociability, (3) Jocularity, (4) Impulsiveness, (5) Sleeplessness, (6) Inferiority, (7) Quick-wittedness, (8) Liveliness, (9) Nervousness, (10) Irritability, (11) Psychosomatic, (12) Masculinity, (13) Sensitivity.

Study B

In this study reported in Eysenck & Eysenck (1969, p. 194-217), 114 EPI items were administered to 1200 Ss (660 males, 600 females). Phi coefficients were computed and factorized separately for males and females by the principal axis method (Principal Components model) and 20 factors were extracted (the rationale employed was the lesser of (a) roots greater than unity or (b) 20 factors). These 20 factors were rotated to oblique simple structure, (4th power Promax) the first twelve factors in each solution (male and female) were interpreted and a coefficient of factor similarity (CFS) (Kaiser, Hunka & Bianchini, 1969) was computed between the factors of the two solutions. These are as follows: (1) Sociability (C.F.S., .97), (2) Impulsiveness (C.F.S., .93), (3) Mood Swings (C.F.S., .95), (4) Sleeplessness (C.F.S., .91), (5) Jocularity (C.F.S., .88), (6) Carefreeness (C.F.S., .80), (7) Nervousnes (C.F.S., .82), (8) Sensitivity (C.F.S., .74), (9) Absent-mindedness (C.F.S., .58), (10) Quick-Wittedness (C.F.S., .53), (11) Social shyness (C.F.S., .60), (12) Lie Scales (C.F.S., .92).

A comparison of the labels in the two studies above reveals that Eysenck found sufficient similarities among the Varimax factors of study A and the Promax factors of study B to ascribe identical labels to eight of these. This dispite differences in rotations, (orthogonal vs. oblique) and perhaps most importantly, in criteria of factor extraction--a variation which is known to seriously affect the results obtained (Hakstian & Muller, 1973).

Also the fact that the best defined among the factors obtained in study B (in terms of the number of salients) were highly similar across sex belies Eysencks contention concerning the unreplicability of primary factors.

The position of the present experimenter is that, although the primary structure among E.P.I. items is not as stable as one could hope for, this is likely due to insufficient density of sampling.

In relation to the position assumed earlier, that sampling should be of a density that provides a stable first order level of factors, it would appear that although in the case of Eysenck's Neuroticism (N), we are dealing with a second or third order level (conceptually) but that the reliability of the composite "N" is only as great as should exist at the primary level.

Moreover, it is regrettable that Eysenck--who is aware that "...such factors as emotionality and extro-version and introversion. If these exist they can be derived only from the observed intercorrelations between the primary traits" (Eysenck & Eysenck, 1969, p. 327)--did

not report the correlation among the primaries.

Study C

Howarth & Browne (1972) administered the EPI (57 items) to 1319 Ss (666 male, 653 female). Phi coefficients were obtained and a principal axis (Components model) factor analysis was performed. Originally fifteen factors (latent roots greater than unity) were extracted. Dr. Howarth has since found that an interpretability criterion would indicate this to be an over extraction and a twelve factor solution to yield a more interpretable result, (although only 9 factors were interpreted). In addition, hierarchical factor analysis subsequently carried out by Dr. Howarth has revealed (a) the "neuroticism components" do coalesce into a broad higher order anxiety factor, (b) the "extroversion components" (e.g., sociability, jocularity, impulsiveness) do not coalesce, so that the recovery of the extroversion scale at the higher order level is poor.

The nine interpreted factors of the twelve factor Promax (4th power) solution are: (1) Adjustment-Emotionality I, (2) Sociability I, (3) Adjustment-Emotionality II, (Hypochondriac) (4) Impulsiveness, (5) Sociability II, (6) Dominance, (7) Lie Scale, (8) Jocularity, (10) Superego.

The Promax factor intercorrelations are presented in Table 1 together with salients (>.30) of the EPI.

Thus the EPI, an instrument which was originally

TABLE 1

PROMAX INTER-FACTOR-CORRELATIONS (EPI)

Salients (EPI Item Number)		1	2	3	4	5	6	7	8	9	10	11	12
9,16,26,47,40,52	1	1											
15,27,51,53,	2	-.28	1										
19,31,33,35,57	3	.41	-.16	1									
5,8,13	4	.12	.15	.22	1								
1,17,20,46	5	.08	-.09	.08	.16	1							
4,22,38,48	6	.18	-.09	.26	.00	-.05	1						
18,24,30,54	7	.10	-.28	.09	.03	.41	.02	1					
10,37,56	8	.05	-.26	-.05	-.05	.14	-.12	.25	1				
40,55	9	.31	.01	.20	.26	.13	.03	.09	.06	1			
14,23,28	10	.06	-.34	.07	-.21	.23	.18	.26	.16	-.18	1		
11,32,42	11	.14	-.49	.14	-.13	.28	.08	.42	.30	.03	.41	1	
6,34	12	.06	.24	.01	.08	-.15	.08	.20	-.18	.13	-.27	-.29	1

derived by correlating items with two Guilford scales R (Rathymia) "as a 'best' measure of extroversion" and C (Cycloid disposition)" as a 'best' measure of neuroticism" (see Browne, 1972 for a description of the development of the EPI) is demonstrably factorially complex. As such it supports the contention originally voiced by Guilford that "...personality is a multi-dimensional affair; that in the usual test several related dimensions have been confused and forced together to form a single somewhat fictitious continuum; and that no measurement of I, E, or any correlation involving I, E, means much unless the name of the test is given" (Guilford, 1934, p. 334).

Placement of the Present Study in the Series- HPQ, HPQ_2, EPI, 16PF, COS, PFI

As indicated earlier, several large studies, Howarth & Browne (1971a, 1971); Eysenck & Eysenck (1969); Sells, Demaree & Will (1968); Jernigan & Demaree (1971) found in the analysis of existing "trait systems" and instruments, that a mutually supportive set of interpretable, content homogeneous empirical factors resulted. It appeared that despite relatively restricted item pools, item factor analysis could provide interpretable primary factors of personality. It thus became important to ascertain whether these factors could be replicated; to this end a 100 item questionnaire was constructed. Howarth & Browne (1971) adopted 67 marker items from the Sells, Demaree & Will (1968)

study, 10 items from Eysenck (1965) and 23 items were included for factor hypothesis purposes. The questionnaire was administered to 329 students, (175 males, 154 females) attending the University of Alberta. In this study the items were restructured for verbal homogeneity and greater clarity and scored dichotomously. The derived inter-item phi correlation matrix was factored by principal axis (Components model) and rotated to simple structure (Varimax). Fifteen factors were rotated and interpreted as: (1) Emotional stability, (2) Sociability, (3) Conscience, (4) Shyness, (5) Relaxed composure, (6) Impulsiveness, (7) Individual tolerance, (8) Considerateness, (9) Group tolerance, (10) Physical Prowess, (11) Energy, (12) Trust vs. Suspicion, (13) Group Affiliation, (14) Rhathymia, (15) Paranoid Sensitivity.

In this attempted replication according to a simple structure criterion, not in the target "Procrustian" sense (Schönemann, 1966),[29] forty-two of 67 markers from Sells, et al. (1968) were recovered loading greater than $\pm .30$ in the hypothesized position. This despite differences in (a) population (male air force personnel vs. male and female University students), (b) scoring of items

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29 In confirmatory F.A. the data are rotated to a least squares fit to a target matrix (also see Overall & Klett, 1972). Guilford uses an earlier form (Cliff's method) of target rotation to "verify" his postulated factors. As yet the sampling distribution of the trace of EE^1 (where E is error of fit) which would provide a significance test of identity of factors across populations has not been obtained (Skakun, 1970).

(trichotomous vs. dichotomous), (c) actual structure of items (items were reworded for simplicity and clarity), (d) factoring model (Common Factor vs. Components) and (e) method of rotation (Promax vs. Varimax). These remarkable results prompted Howarth & Browne (1971)[30] to conclude: "The fact that we have been able to observe the reappearance of many of Sell's factors would appear to indicate that large scale item-factor-analysis is a worthwhile proposition and should be pursued to discover replicable factors" (Howarth & Browne, 1971, p. 171). In this light a large comprehensive study was undertaken (COS study-Canada Council Grant S70-0694).

COS Study

The item pool--"The conceptual framework for the item pool was very straight forward. A survey of the literature was carried out beginning with the early formation of item ideas put forth by Freyd (1924)...with the specific orientation of selecting only those instruments that were either developed specifically for assessing E-I and its (often)

30 This HPQ study was undertaken following Dr. Howarth's reading of the original unpublished Eysenck manuscript in 1966. In 1969 he also obtained a copy of the Sells (report) study and abstracted factors and variables for the HPQ marker study from both these sources. The HPQ_2 study then followed, after which 16PF, EPI etc. The present study was one of four, three of which were completed in 1971/72 in the ensuing PFI series. (For simplicity, and consistency, the latter item pool is referred to as HPQ as it is part of a development series, and was actually the <u>fourth</u> attempt at a structured (marker) item pool).

related concept of adjustment, or which had been used prominently with scales to assess extroversion, a number of item-sources were amassed" (Browne, 1971, p. 98).

The original sources included over 25 questionnaires represented by more than 3000 items. For a variety of reasons some sources were deleted. Some 1726 items were individually recorded on index cards and re-grouped according to item content and scale or factor for which they were originally representative. This resulted in 20 more homogeneous aggregates which were labelled "Putative Factor Hypotheses".

This accounted for some 1400 items. Thereafter, nonoverlapping items from each putative factor hypothesis were selected,[31] 31 items which were invented. The 400 items consisting of 20 "factor hypotheses" each represented by 20 items were assembled as an experiment and titled for convenience "Comprehensive Opinion Survey" (COS).

The original sources represented in COS were:

1	Heidbreder List	4
2	Neymann-Kohlstedt	10
3	Stagner and Pessin	5
4	MMPI	21
5	GZTS	79

31 This was not carried out blindly, instead the leading salients from recent large scale item-factorings were selected. In other words many of the items were (potential) factor markers. The experimental COS questionnaire was thus designed as being somewhat on the continuum between "exploratory" and "confirmatory" factor analysis.

6	Heron Scale	10
7	MPI	15
8	CPI	12
9	Pittsburgh SEI	2
10	EPI, A	12
11	B	11
12	16 PF A	37
13	B	33
14	C	21
15	OPI	52
16	PEN	2
17	Comrey Scales	12
18	HPQ_2	25
19	Sensation Seeking	6
20	Invented	31

This questionnaire with the cooperation of Psychologists from 13 universities across Canada was administered to 1003 undergraduate students (488 female and 575 male)[32] attending same, thus ensuring a representative sample of the English speaking student population[33].

The inter-item (401 x 401, sex included) phi-correlation matrix was factored by principal axis method (Components model) separately for males, females and males and females combined. Initially in accordance with the hypothesized

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32 Actually some 1500 were returned. Due to incomplete answere and comments (e.g., "you're trying to examine my sex life") a large number were rejected. It is Dr. Howarth's present opinion that this reduced the anxiety variance in the COS solution, and thereby affected the nature of the solution.

33 All 13 Universities are English except for two, Laurentian University and the University of Ottawa, which are bilingual.

number of factors 20 factors were extracted and rotated to orthogonal simple structure[34] (Varimax). This resulted in twelve interpretable factors: (1) Sociability (SY), (2) Social Shyness (SH), (3) Adjustment-Emotionality (AE), (4) Mood Swings-Readjustment (MR), (5) Trust vs. Suspicion (TS), (6) Persistence (PS), (7) Impulsivity (IP), (8) Freudian Introversion (FI), (9) Dominance (AD), (10) Sex and Superego (SX/SG), (11) General Activity (GA), and to a lesser extent (12) Cooperativeness-Considerateness (CC) featured in all three analyses, the remaining factors in these respective solutions were either not interpretable, sex specific or did not warrant the confidence that a label should imply. Since the intent of the authors was to focus on "replicable factors" a combined 12 factor Varimax rotation was obtained, it proved to be highly interpretable and was selected as the definitive solution. In this solution MR (Mood Swings-Readjustment) and GA (General Activity) did not appear, one factor was not interpretable and a new factor, Inferiority (IF) was identified.

In this analysis, each factor was represented by several salients which permits proper identification in terms of the content of the item aggregate and "definition" in the sense that several relatively homogeneous variables

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34 Since most "canned programs and subroutines" are dimensioned for 50 to 150 variables this in itself involved generating a program capable of factoring (Householder-Ortega Wilkinson algorithm) 450 variables and rotating (Varimax). (Howarth & Braun, 1972; also see Howarth, 1971).

correlating with a single underlying variable implies a "scale"[35].

The salients defining these 12 psychologically distinct and "independent" if not orthogonal dimensions were in the past employed as "measures" of either extroversion-introversion or neuroticism. In this light the following conclusion by Browne (1971) seems apropos: "The categorization of individual differences in personality is dependent upon the identification and establishment of stable and replicable primary trait dimensions which have been obfuscated by appealing to the very broad notion of "extroversion". The "lumping" of individuals into arbitrarily defined categories obscures the very nature of individual differences and at the same time renders their measurement impossible (p. 193).

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Factor 1	Title	Salients
1	Sociability (SY)	43
2	Adjustment Emotionality (AE)	31
3	Social Shyness (SH)	18
4	Trust vs. Suspicion (TS)	18
5	Impulsivity (IP)	18
6	Persistence (PS)	15
7	Sex and Superego (SX/SG)	12
8	Thoughtfulness (possibly Thinking) Introversion (TI))	21
9	Dominance (AD)	14
10	Unidentified	13
11	Cooperativeness-Considerateness (CC)	8
12	Inferiority (IF)	7

The item content of the HPQ is approximately 60% derived from the COS study[36]. However, other large studies discussed earlier, e.g., Howarth, et al. (1971 1971a, and 1972) also contributed.

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36 Just as the COS item pool was an experimental questionnaire selected in terms of, and guided by the results of previous studies, so the present measure (of which this study analyzes the French translation) is part of an on going cycle of hypothesis--test-modified hypothesis. This is very different from much of F.A. in the past (see Howarth, 1972) in that (a) large scale comprehensive F.A. are used (b) these are by no means "one shot" factorings. For the result of the latter see French's (1953) survey of all extant (at that time) factorings of personality variables.

Method

Item and Test Formats

The Howarth Personality Inventory (HPQ) (Howarth, 1973)[37] (see Appendix I) is made up of ten putative factor scales each represented by twelve dichotomously scored items. The putative factors are: (1) Sociability (SY), (2) Adjustment Emotionality (AE), (3) Ascendence (AD), (4) Super Ego (SG), (5) Hypochondriac Medical, (6) Impulsivity (IP), (7) Cooperativeness-Considerateness (CC), (8) Inferiority (IF), (9) Persistence (PS), (10) Trust vs. Suspicion (TS).

The HPQ was first translated into French independently by a French Instructor and the writer; these two translations were then consolidated with the aim of obtaining as far as possible semantic equivalents[38]. As in the

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37 The particular measure in which this French language translation was based was the fourth in the HPQ series. Research is now preceeding on a fifth version in various studies--Clinical, Counselling, Armed Forces, Rehab. Medicine, Unemployed and a Provincial study of volunteers. (See e.g., Behavioral Research and Service Newsletter, v. II, Nos. 1&2 (Sept. 1972 & Jan. 1973).

38 Dr. Gilles Cadrin, a memeber of the department of Romance Languages at the University of Alberta assisted in the translation.

English version, the format is such that markers for a given factor appear equally spaced at intervals of ten items. As an example, markers for sociability are items 1, 11, 21, 31...111. Thus, the item marker source can be identified by the last digit of the variable. These are SY(1), AE(2), AD(3), SG(4), HM(5), IP(6), CC(7), IF(8), PS(9), TS(0).

Subject Sample

Subjects (538) consisted of both male (275) and female (263) students attending Francophone Universities in the Province of Quebec (see table 2).

Procedure

Administration of test

The HPQ[39] together with an answer sheet and a pencil was given to each student in all the eight different classes. The instructions which appear on the answer sheet were orally translated by the writer with the singular amendment that they were informed that it was not important whether or not their name appeared on the answer sheet.

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39 Actually, a mimeographed form was administered which differed only slightly from the printed form. Variable number 69 was omitted in error. In order not to disturb the format the variable was scored as positive (1) negative (0) if the S's score was above or below six on the scale respectively. For all purposes variable sixty-nine is a dummy variable even though it is not noted as such throughout the analysis.

TABLE 2

SUBJECTS

		# of Males	# of Females	# Total
University of Montreal	Psychology (1)	61	50	111
University of Montreal	Special Education (1 & 2)	15	72	87
Laval University	Education (1 & 2)	70	41	111
Laval University	Psychology (3)	23	22	45
Laval University	Psychology (2)	12	15	27
University of Quebec at Three Rivers	Psychology (2)	26	12	38
University of Sherbrooke	Psysical Education (1 & 2)	50	17	67
University of Quebec at Montreal	Psychology (1 & 2)	18	34	52
		275	263	538

SUBJECT STATISTICS

Subjects	Mean Age	Standard Deviation
Males	22 years, 5 months	1 year, 11.7 months
Females	21 years, 6 months	2 years, 4.5 months
Combined	21 years, 11.5 months	2 years, 2.6 months

Scoring

All answer sheets were inspected for incomplete responding. In all eleven answer sheets were discarded[40] due to S's having omitted information as to their sex or did not answer more than 117 of 120 items.

A scale score was computed for every subject on each of the 10 putative scales. The male (275) and female (263) data sets were then punched separately onto IBM cards. Variables to be factor analyzed included the 120 items, sex, and the 10 scale scores.

In order to obtain split halves for the scale scores each subject score was computed on the first six items and the last six items of any scale. These 20 scores per S together with the S's age in months were punched separately onto IBM cards.

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40 A vast difference from COS study in which one third of the 1500 questionnaires were discarded (thus, quite possibly, distorting the solution vis-à-vis 'sociability factors' relative (variance wise) to "anxiety factor").

Analysis and Results

The analysis is structured into three parts. Part I deals with the factor analytic reproducibility of the putative factors. Part II is concerned with assessing the itemetric properties of the scales and Part III involves an attempt to reproduce in the absence of any constraints and indeed by slightly different methods the factors of the HPQ.

Part I

Factoring

The 120 test items together with the scale scores of the putative ten factors as well as the sex variable were all intercorrelated yielding amongst the items phi coefficients, between the items and the scale scores biserial coefficients and Pearson product moments among the scale scores. The derived matrix (131 x 131) was factorized (12 factors were extracted on the assumption that if ten relatively unitary constructs were present they would not fission while allowing from some error) by principal axis method (Components model) using the Householder-Ortega-Wilkinson algorithm (Howarth & Braun, 1972). The first 12 eiganvalues were

as follows: 13.51, 7.13, 5.96, 5.04, 3.27, 2.93, 2.67, 2.52, 2.30, 2.12, 1.94, 1.79.

Rotations

A series of 11 and 12 factor rotations were performed in order to ascertain how robust the factors are across rotational criteria as well as possibly determining the best rotational proceedure given the nature of the data. Including the scale scores permits an assessment of the factor purity of a given scale[41].

Three classes of solutions were employed:

(a) generalized orthomax, Saunders (1962); Harris and Kaiser (1964); and Hakstian (1970) in which several prominent orthogonal methods--quartimax, varimax, equamax are seen as special cases of a more general "orthomax" criterion of the form.

$$n \sum_{j=1}^{n} \sum_{p=1}^{m} bjp^4 - w \sum_{p=1}^{m} \left[\sum_{j=1}^{n} bjp^2 \right]^2 = MAX$$

in which bjp is the loading of variable j on orthogonally transformed factor p, n is the number of variables, w the general othomax parameter. It has been shown, (Hakstian, 1969) that increasing the value

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41 But also prejudices the factor solution in a common factor analysis (but less so in principal components) because of the greater variance (and hence potential co-variance) of the scale scores.

of w has the effect of distributing the total variance more equitably among the factors. Setting the parameter w to 0, 1, m/2 yields quartimax, varimax and equamax respectively however, "there is evidence...that superior orthogonal solutions...may be obtained using values of w other than 0, 1 and m/2..." (Hakstian, 1970, p. 700). Accordingly, orthomax solutions for twelve factors were obtained with w=1, 1.6, 2 and 6, and eleven factor solutions with w set to 4,6 and 50.

(b) Harris & Kaiser (1964) Independent Cluster Solution, a special case of a class of oblique solutions which seems appropriate to the present problem as it is the "ideal" solution for factorially simple data, whether correlated or orthogonal. Harris et al. consider it "fundamental" for the following reason:

> First many research workers in studying psychological domains develop batteries of variables, the common parts of which are explicitly intended to have the independent cluster pattern. In all such cases our (independent cluster solution) "is a simple, direct and unambiguous way to develop the evidence that will attest to the success of this intent, if in fact it is successful" (Harris & Kaiser, 1964, p. 359).

(c) A class of orthogonal solutions, i.e., orthomax discussed above implies a class or Promax (Hendrickson & White, 1964) type oblique rotations, in which a target matrix is set up in terms of second, fourth or some other "power" of an orthogonal rotation and

the least squares fit to that matrix is a Promax solution. In an attempt to improve on the independent cluster solution 2nd, 4th, and 6th power Promax was placed on the orthomax solution W=50 with a program supplied by Dr. Howarth[42]. Solutions G, E, H, orthomax (w=4 and 50) and the unnormalized Independent Cluster solution provided the most confirmatory rotations; accordingly the salients (>.25) of solutions G and H, orthogonal and oblique respectively are reported.

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42 This is a modified form of normalized Varimax coupled with the very latest dynamic storage allocation Promax. (Technical note: Some few persons (e.g., J. Horn) advocate 5th power Promax, but Dr. Howarth, in consulatation with the originator of Promax (P.O. White) prefers to remain with even powering). Dr. Howarth finds that equamax-based solutions lead to some factor fission in small matrices of around 120 variables. This disadvantage is offset by the overcoming of the fusion problem. Thus "as one overcomes fusion, one becomes involved in fission".

The computing algorithm for the Promax rotation is:

V = varimax matrix

B = target matrix (i.e., powers of elements in V with original signs attached)

L = $(V^1V)^{-1}\ V^1BD_1$

D_1 = diagonal matrix which normalizes columns of L (i.e., diagonal matrix of reciprocal square roots of diagonal elements of $B^1V(V^1V)^{-2}V^1B$)

T = $(L^1)^{-1}D_2$

D = diagonal matrix which normalizes columns of T (i.e., diagonal matrix of reciprocal square roots of diagonal elements of $L^{-1}\ (L^1)^{-1}$

I = T^1T (interfactor correlations)

S = VT (primary factor structure)

A = SI^{-1} (primary factor pattern)

TABLE 3

A COMPARISON OF VARIOUS TRANSFORMATIONS

Scale Score	A		B		C		D		E		F		G		H		I	J	K
	*	**	*	**	*	**	*	**	*	**	*	**	*	**	*	**	*	*	*
SY	84	4.5	84	4.6	85	4.7	85	4.7	90	5.1	86	4.8	91	5.2	87	4.9	88	89	90
AE	86	7.0	82	6.2	79	5.6	74	4.1	74	5.3	72	4.7	73	4.6	78	5.4	71	73	72
AD	85	4.5	95	4.5	95	4.5	95	4.5	95	4.5	95	4.6	96	4.5	97	4.2	96	97	97
SG	91	4.2	91	4.2	91	4.2	91	4.2	91	4.2	91	4.2	91	4.3	92	4.0	91	92	92
HM	73	4.0	74	4.2	72	4.2	69	4.1	81	4.9	83	4.8	81	4.2	85	4.9	77	79	81
IP	93	4.7	93	4.7	93	4.7	94	4.7	92	4.7	93	4.8	93	4.9	92	4.7	92	92	92
CC	84	3.6	85	3.6	85	3.6	85	3.7	84	3.8	84	3.8	85	4.0	90	4.1	84	88	90
IF	50	3.9	56	2.8	67	3.5	74	4.2	79	4.3	64	4.4	80	4.8	83	4.9	77	82	87
PS	92	5.7	92	5.6	92	5.5	90	5.1	91	5.4	90	5.2	87	4.5	95	5.3	88	92	93
TS	87	4.2	88	4.3	88	4.3	87	4.2	87	4.2	88	4.3	87	4.2	88	4.3	84	84	83
***	825		840		847		844		864		846		864		887		848	868	877

* scale score loading; decimal point omitted

** sums of squares of column loadings

*** mean loading of scale scores; decimal point omitted

A--12 factor orthomax w=1
B--12 factor orthomax w=1.6
C--12 factor orthomax w=2
D--12 factor orthomax w=6
E--11 factor orthomax w=4
F--11 factor orthomax w=6
G--11 factor orthomax w=50
H--11 factor independent cluster solution (unnormalized)
I-- G based Promax (2nd power)
J-- G based Promax (4th power)
K-- G based Promax (6th power)

FACTOR 1*

**	V	***	****	
	122	-.91	.87	(Scale Score for SY)
(SY)	81	-.69	.73	I enjoy parties where there are lots of people
(SY)	111	.67	-.73	I prefer to stay at home with a hobby rather than attend a lively party
(SY)	31	-.68	.72	I like to attend lots of social functions.
(SY)	51	-.63	.64	At a party I like to meet as many people as I can.
(SY)	21	-.60	.69	Do you like going out a lot?
(SY)	101	.57	-.54	I generally keep in the background on social occasions.
(SY)	91	-.54	.44	I am a sociable outgoing person.
(SY)	1	.43	-.48	I prefer to vacation "away from the crowd".
(SY)	41	-.37	.23	I make new friendships easily.
(SY)	61	-.34	.22	It is easy for me to talk with people.
(SY)	71	-.25	.33	I am a good social mixer.

* Items shown below are not those used in this study. This comment applies to all factor markers in part I and part III

** Source Factor

V Variable

*** Loading Orthogonal Solution; Solution G

**** Loading Oblique Solution; Solution H

FACTOR 2

	127	-.93	.92	(Scale Score for IP)
(IP)	76	-.66	.70	On the whole I am a rather impulsive person.
(IP)	86	-.63	.65	I act on the first thought that comes into my head.
(IP)	46	-.62	.64	I seldom make decisions on the spur of the moment.
(IP)	26	-.61	.59	I often act on suggestions quickly without stopping to think.
(IP)	16	.53	-.56	I rarely act without careful consideration.
(IP)	66	.52	-.53	I believe in the saying "look before you leap".
(IP)	116	.46	-.42	I enjoy doing daring, foolhardy things.
(IP)	96	.41	-.43	Uncontrolled impulsiveness is not part of my makeup.
(IP)	6	-.37	.32	I enjoy taking risks just for fun.
(IP)	36	-.33	.27	Do people say you sometimes behave rashly?
(IP)	106	-.04	.38	I usually say what I feel like saying at the moment.
(IP)	56	-.34	.28	Other people think of me as being serious minded.

FACTOR 3

	129	-.80	-.84	(Scale Score for IF)
(IF)	48	.62	.66	Are you a self confident person?
(IF)	78	-.54	-.61	Are you troubled with feelings of inferiority?
(IF)	88	.52	.50	Very few events disturb my self-confidence.
(IF)	38	.46	.59	I am most often successful in dealing with people.
(IF)	58	-.44	-.41	Are your feelings easily hurt?
(IF)	108	-.44	-.40	Are you easily hurt when people find fault with you?
(SY)	61	-.39	-.55	It is easy for me to talk with people.
(IF)	68	.39	.40	I feel confident that I will succeed in life.
(SY)	41	.33	.43	I make new friendships easily.
(AE)	72	-.31	-.23	I am frequently over-annoyed by small setbacks.
(SY)	91	.31	.37	I enjoy parties where there are lots of people.
(AE)	52	-.30	-.17	I am easily "rattled" and upset.
	123	-.29	-.07	(Scale Score AE)
(AE)	2	.28	.20	I find it easy to put my worries aside and relax.
(HM)	55	.27	.14	I almost always feel well and strong.
(SY)	71	.26	.33	I am a good social mixer.
(CC)	17	.24	.34	I seldom get an unreasoning dislike for another person.
(IF)	28	.19	.29	At a social event people are usually glad to meet me.

FACTOR 4

	123	.73	-.78	(Scale Score for AE)
(AE)	112	.55	-.61	I sometimes feel happy and sometimes depressed without any apparent reason.
(AE)	62	.54	-.67	Sometimes quite trivial troubles keep going around in my mind.
(AE)	32	.53	-.67	I often feel just miserable for no good reason.
(AE)	102	.50	-.57	Have you often felt listless or tired for no good reason?
(AE)	72	.49	-.49	I am frequently over-annoyed by quite small setbacks.
(HM)	45	.42	-.41	I sometimes lack energy when I need it.
(AE)	52	.39	-.36	I am easily "rattled" and upset.
	121	-.38	.39	(Sex)
(TS)	30	.38	-.40	There are times when it seems everyone is against you.
(AE)	82	.36	-.36	I frequently worry about possible misfortunes.
(AE)	42	.34	-.43	You feel lonesome even when you are with other people.
(IF)	58	.33	-.26	Are your feelings easily hurt?
(IF)	108	.30	-.20	Are you easily hurt when people find fault with you?
(AE)	2	-.29	.24	I find it easy to put my worries aside and relax.
(AD)	33	.29	-.39	
	126	.29	-.14	(Scale score for HM)
(AE)	22	.28	-.29	People often say or do things which annoy me.
(AE)	12	.28	-.32	I sometimes feel that life is not worth living.
(HM)	5	.28	-.39	I am inclined to be moody.
(HM)	55	-.28	.19	I almost always feel well and strong.
(AD)	13	-.20	.28	When I work on a committee I like to take charge of things.

FACTOR 5

	126	-.81	.85	(Scale Score for HM)
(HM)	115	-.60	.67	Are you troubled by aches and pains?
(HM)	65	-.58	.65	I often lose sleep over my worries.
(HM)	75	-.56	.63	Do ideas run through your head and prevent you from sleeping?
(AE)	92	-.55	.56	Do you suffer from "nerves"?
(HM)	85	-.53	.56	Do you often get heart thumping or palpitations?
(HM)	95	-.47	.50	Do you worry about your health?
(HM)	35	-.47	.51	I sometimes get very bad headaches.
(HM)	105	-.38	.45	Do you frequently have attacks of shaking and trembling?
	123	-.34	.15	(Scale for AE)
(HM)	55	.31	-.27	I almost feel well and strong.
(HM)	15	.31	-.30	You are troubled by unusual fears or distastes.
(AE)	72	.27	-.20	I find it easy to put my worries aside and relax.
(AE)	82	-.27	.09	I frequently worry about possible misfortunes.

FACTOR 6

	130	-.87	.95	(Scale Score for PS)
(PS)	69	-.76	.83	I persist on a job until it is completed even when others have given up.
(PS)	79	-.51	.57	I am able to work long hours without rest.
(PS)	9	-.48	.53	I am more persistent than most.
(PS)	99	-.48	.53	When perplexed by a difficult problem I keep trying to solve it.
(PS)	19	.45	-.49	I give up easily.
(PS)	109	-.44	.50	Whatever the difficulties I stick to my original intentions.
(PS)	119	-.44	.46	I am regarded as a very energetic person.
(PS)	39	.44	.47	My enthusiasm for a new project does not persist.
(PS)	59	.43	-.46	It is hard for me to work continuously on a scholarly problem.
(PS)	89	.43	-.47	I find myself starting things and then losing interest in them.
(IF)	118	-.40	.41	I usually succeed in anything that I attempt.
(IF)	18	-.36	.39	I usually realize my personal expectations.
(PS)	49	.34	-.40	I am inclined to take my work casually.
(HM)	45	.32	-.35	I sometimes lack energy when I need it.
(PS)	29	-.28	.33	I believe that "if at first you don't succeed, try, try again".

FACTOR 7

	124	-.96	-.97	(Scale score for AD)
(AD)	13	-.57	-.58	When I work on a committee I like to take charge of things.
(AD)	83	-.56	-.53	People say that I have leadership ability.
(AD)	53	-.56	-.55	I like to take command by knowing what is best for my group.
(AD)	103	-.54	-.57	People who argue with me generally come off worse.
(AD)	63	-.50	-.49	I dominate many of my acquaintances of about my age.
(AD)	73	-.49	-.48	People have told me that I am a dominant person.
(AD)	93	-.49	-.48	My opinion often sways others.
(AD)	3	-.46	-.49	I am often inclined to go out of my way to win a point over someone.
(AD)	23	-.42	-.44	I speak out in meetings to oppose those whom I feel sure are wrong.
(CC)	107	-.33	-.30	I easily become involved in straightening out other people's problems.
(AD)	113	-.31	-.36	Do you find it hard to take NO for an answer?

FACTOR 8

	125	-.91	-.92	(Scale Score for SG)
(SG)	4	-.65	-.65	Individuals should always show respect for the law.
(CC)	37	.57	-.56	I always try to follow the golden rule.
(SG)	44	-.52	-.51	I think strongly that churches deserve our financial support.
(SG)	34	.50	.51	Good manners are extremely important.
(SG)	14	-.53	-.49	I prefer to go my own way rather than acting on approved rules.
(SG)	24	-.46	-.43	I admire my parents in all important matters.
(SG)	74	.39	.43	I approve of contemporary sexual morality.
(SG)	104	.36	.35	I have often gone against my parent's wishes.
(SG)	94	-.33	-.30	The police can be trusted not to ill-treat innocent people.
	128	-.30		(Scale for CC)
(SG)	114	.28	.34	I think I am more easy going about right and wrong than most people.
(SG)	64	-.28	-.28	This country needs higher standards of conduct.
(CC)	97	-.26	-.15	I make a point of helping others.
(CC)	67	.26	.19	If asked to work on a charity drive I would politely say I was busy.

FACTOR 9

	131	-.87	.88	(Scale Score for TS)
(TS)	100	-.62	.69	Most people cheat if they can get away with it.
(TS)	110	-.59	.61	There are many unreasonable people about.
(TS)	40	-.56	.61	Most people will tell a lie to keep out of trouble.
(TS)	50	-.56	.60	Many people try to get more than they give.
(TS)	60	.46	-.52	Most people respect the rights of others.
(TS)	90	-.45	.46	I sometimes suspect the motives of others.
(TS)	120	-.45	.47	People pretend to care more about one another than they really do.
(TS)	70	-.32	.30	I have been seriously slighted more than once.
(SG)	54	-.32	.32	I think that moral standards are falling.
(AE)	22	-.31	.24	People often say or do things which annoy me.
(SG)	64	-.30	.28	This country need higher standards of conduct.
(TS)	80	-.29	.26	I distrust people I have just met until I get better acquainted.
(SG)	114	-.26	.31	I think I am more easy going about right and wrong than most people.
(TS)	10	-.25	.21	I often wonder what hidden reason another person may have for doing something nice for me.
(TS)	30	-.26	.19	There are times when it seems everyone is against you.

FACTOR 10

	128	-.85	-.90	(Scale Score for CC)
(CC)	97	-.48	-.48	I make a point of helping others.
(CC)	77	-.48	-.50	To be helpful I don't mind tackling a dirty job that others will not perform.
(CC)	27	-.48	-.52	I do what is necessary to keep harmony in a group meeting.
(CC)	7	-.45	-.49	I am a helpful and cooperative person.
(CC)	87	-.45	-.48	If a person gets angry with me I try to calm them down.
(CC)	57	-.39	-.41	I always try to do unto others as I would have them do to me.
(CC)	107	-.35	-.38	I easily become involved in straightening out other people's problems.
(CC)	117	-.41	-.41	I refrain from criticizing other people.
(CC)	67	.32	.32	If asked to work on a charity drive I would politely say I was busy.
(CC)	47	-.32	-.37	I soon forget if another person takes momentary advantage of my friendliness.

FACTOR 11 (I.C. Solution)

6	.48	I enjoy taking risks just for fun.
5	.28	I am inclined to be moody.
80	.26	I distrust people I have just met until I get better acquainted.
36	.25	Do people say you sometimes behave rashly.

In the solutions presented above, 103 and 101 of 120 items were found to load $>\pm.25$[43] on the factor they were intended to measure in the orthogonal and oblique solutions respectively. In order to evaluate the simple structure an analysis of the loading pattern in the Independent Cluster solution is illustrated. In Table 4 the variables are categorized as; A--items with loadings greater than $\pm$ .50 or $\pm$ .30 on one factor, the second highest loading less than $\pm$ .20. Ninety-one variables fall into this class. B--items with loadings greater than $\pm$.40 but the second variable loading greater than $\pm$.20 on a second factor. Eight variables occupy this class. C--variables which load in excess of $\pm$.25 on one factor but greater than $\pm$.20 on a second factor. Fourteen variables are of this class and D--items without loadings on any factor greater than $\pm$.25. There are seven such variables.

As indicated earlier, it is possible to have variables loading on a factor without being highly homogeneous with other variables that load on the factor. Of course, the converse is also possible, variables can be

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43 This does not mean that $\pm$.25 is considered salient by the present experimenter, i.e., certain other criteria (to be discussed) must also be met. However, it is possible, in some cases, that a loading of .25 could be considered salient, for example the case of a factor pure variable, which because of a highly biased mean, and hence restricted potential covariance does not have a high loading.

TABLE 4

SIMPLE STRUCTURE ANALYSIS***

	SY		AE		AD		SG		HM		IP		CC		IF		PS		TS		RT	
	*	**	*	**	*	**	*	**	*	**	*	**	*	**	*	**	*	**	*	**	*	**
	81	73	62	67	13	58	4	65	115	67	76	70	27	52	48	66	69	83	100	69	6	48
	111	73	32	67	103	57	37	56	65	65	86	65	77	50	78	61	79	57	110	61		
	31	72	112	61	53	55	44	51	25	64	46	64	7	49	38	59	9	53	40	61		
A	21	69	102	57	83	53	34	51	75	64	26	59	97	48	61	55	99	53	50	60		
	51	64	72	49	3	49	14	49	92	56	16	56	57	41	88	50	109	50	60	52		
	101	54	42	43	63	49	24	43	85	56	66	53	117	41	41	43	19	49	120	47		
	1	48	30	40	73	48	74	43	35	51			47	37	68	40	39	47	90	46		
	11	39	12	32	93	48	94	30	95	50			67	33	108	39	89	47	54	32		
	71	33	52	36	23	44	104	35	105	45							59	46				
			82	36	113	36			15	30							119	46				
																	18	39				
																	29	32				
	91	44													91	37						
			45	41													45	35				
B											96	43			96	26						
											16	42									116	44
			87	26									87	48								
																	49	40			49	28
	58	26													58	41					58	25
															118	26	118	41				

	SY	AE	AD	SG	HM	IP	CC	IF	PS	TS	RT
	* **	* **	* **	* **	* **	* **	* **	* **	* **	* **	* **
		5 39									5 28
		17 22					17 34				
		22 29								22 24	
								28 29			28 20
C		33 39			33 27			33 29			
					36 25	36 27		36 22			36 25
					55 27			55 22			
						56 28		56 21			
				64 28						64 28	
		70 20					70 21			70 30	
						80 21	80 22			80 26	80 26
						106 38		106 24			
			107 30				107 38				
		114 20		114 34						114 31	
D		2	43	84				8		10	
								98		20	

* item number

** absolute item loading (decimal point omitted)

*** Independent Cluster solution (Harris & Kaiser, 1964)

relatively highly intercorrelated but because they are factorially complex, they will not load highly on a given factor. In this light, in addition to requiring a substantial loading e.g., in excess of $\pm.40$[44] a further requirement is that the variables loading on a factor be in general significantly intercorrelated (here $p<.01$). If factors are conceived as determining covariation surely one requires that the covariation be significant.

In this respect, so as not to fool yourself with factor analysis, the author agrees with Nunnally, (1965) that "...the safe proceedure is to inspect the original matrix of correlations to ensure that variables used to define a factor actually have substantial correlations" (p. 369). This aspect of the analysis will be revisited in Part II.

The interfactor correlations as well as the interscale correlations are presented in Table 5. It will be observed that they are similar since the scales are relatively factor pure.

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44 $\pm.40$ is admittedly arbitrary, but not exceedingly high in view of the fact that the loadings include a spurious component, i.e., by their relation to the scale scores.

TABLE 5

INTER-FACTOR INTER-SCALE CORRELATION MATRIX

	SY	AE	AD	SG	HM	IP	CC	IF	PS	TS
SY	1	.16*	-.10	-.16	-.07	.17	-.32	.33	.08	-.10
		-.25**	-.15	- 17	- 18	16	34	- 33	.14	-.15
AE		1	.01	-.01	-.53	.18	-.26	.51	.29	-.40
			-.01	-.02	.63	-.18	-.24	.55	-.28	.47
AD			1	.03	-.07	-.12	.09	-.23	-.25	.17
				.02	.03	.14	.10	-.24	.26	13
SG				1	.08	.13	.32	-.04	-.18	.06
					-.09	-.16	.37	-.07	16	.05
HM					1	.19	.16	.35	-.18	.32
						17	-.19	.45	-.23	.36
IP						1	.07	.07	-.23	.06
							-.12	.06	-.22	.07
CC							1	-.34	-.29	.11
								-.26	.28	-.12
IF								1	.40	-.21
									-.44	.25
PS									1	-.06
										-.09
TS										1

* upper correlation is inter-factor

** lower correlation is inter-scale

PART II

Here, we are concerned with evaluating the itemetric properties of the scales. Split-half reliabilities (Table 6), uncorrected item total correlation (Table 7) and scale means and standard deviations (Table 8) are reported as well as the homogeneity of the scales expressed as the percentage of significant inter-scale correlations ($p<.01$), see Howarth, Browne, & Marceau (1972).

TABLE 6

SPLIT-HALF RELIABILITIES

SCALE	MALE	FEMALE	COMBINED
SY	.69	.67	.69
AE	.59	.58	.59
AD	.51	.41	.47
SG	.35	.46	.41
HM	.51	.58	.55
IP	.61	.62	.61
CC	.43	.39	.43
IF	.59	.66	.63
PS	.54	.68	.62
TS	.61	.57	.59

TABLE 7

UNCORRECTED ITEM-TOTAL CORRELATIONS

SY		AE		AD		SG		HM		IP		CC		IF		PS		TS	
*	**																		
1	-.41	2	-.50	3	.47	4	.59	5	.37	6	.50	7	.47	8	.29	9	.52	10	.45
11	-.45	12	.46	13	.57	14	.52	15	.44	16	-.49	17	.28	18	-.32	19	.48	20	.35
21	.52	22	.53	23	.44	24	.48	25	-.60	26	.58	27	.52	28	-.26	29	.32	30	.48
31	.65	32	.59	33	.22	34	-.49	35	.47	36	.48	37	.36	38	-.49	39	-.54	40	.55
41	.58	42	.49	43	.28	44	.52	45	.46	46	-.60	47	.30	48	-.67	49	.36	50	.48
51	.66	52	.57	53	.58	54	.17	55	-.55	56	-.42	57	.41	58	.52	59	-.55	60	-.44
61	.51	62	.46	63	.52	64	.41	65	.63	66	-.49	67	-.46	68	.55	69	.83	70	.45
71	.43	72	.62	73	.51	74	-.41	75	.62	76	.63	77	.48	78	.60	79	.56	80	.46
81	.67	82	.55	83	.59	84	.26	85	.50	86	.60	87	.44	88	-.58	89	.53	90	.51
91	.70	92	.45	93	.49	94	.31	95	.50	96	-.42	97	.56	98	-.25	99	.54	100	.56
101	.59	102	.56	103	.51	104	-.39	105	.35	106	.42	107	.38	108	.55	109	.45	110	.57
111	.62	112	.66	113	.34	114	-.26	115	.48	116	.57	117	.39	118	-.41	119	.54	120	.56

* Item number

** Biserial correlation with scale score

TABLE 8

MEANS AND STANDARD DEVIATIONS

	SY	AE	AD	SG	HM	IP	CC	IF	PS	TS
MEAN	7.00	4.85	6.13	5.01	3.22	4.14	7.87	3.61	8.05	6.22
S.D.	3.23	3.12	2.61	2.27	2.60	2.86	2.31	2.37	2.77	2.67

INTER SCALE HOMOGENEITY

There are 12 items per scale, therefore 66 possible significant inter-item correlations for each scale. To be significant ($p<.01$) correlations must exceed .11. In the following table (Table 9) the percent of significant correlations per scale is given as well as the mean inter-scale significant correlations. It occurs that the percentage is unduly deflated due to one or two items which appear not to belong to the scale in question. As such a revised table (Table 9a) is presented indicating the new percentage of significantly intercorrelated items as well as the unsatisfactory items.

TABLE 9

PERCENTAGE OF INTER-SCALE SIGNIFICANT CORRELATIONS

Scale	SY	AE	AD	SG	HM	IP	CC	IF	PS	TS
Percent Significant* Intercorrelations	94	95	62	50	86	86	45	56	86	75
Mean of Significant Intercorrelations	.27	.24	.22	.18	.21	.23	.17	.23	.23	.19

* .01

TABLE 9a

REVISED PERCENTAGE OF INTER-SCALE SIGNIFICANT CORRELATIONS

Scale	SY	AE	AD	SG	HM	IP	CC	IF	PS	TS
Revised Percent Significant Intercorrelations	94	95	92	82	91	93	91	90	98	84
Minus Scale Items	--	--	33	64	5	6	17	18	29	10
			43	54		106	47	28		20
			113	84			37	98		70
				114						80

Adopting a saliency criteria of .40 as well as the requirement that the items must be 85% significantly intercorrelated ($p<.01$) we are left with the following factor salients. All inter-item correlations as well as mean intercorrelations are reported (Tables 10 to 19). This does not imply that other items within the scale are unworthy of the scale but merely an attempt is made to summarize the information regarding the best markers for each factor.

TABLE 10

FACTOR (SY)

Source	Item	*Loading	Item Mean	Standard Deviation
(SY)	81	.73	.40	.49
(SY)	111	-.73	.38	.49
(SY)	31	.72	.42	.49
(SY)	21	.69	.56	.50
(SY)	51	.64	.52	.50
(SY)	101	-.54	.25	.43
(SY)	1	-.48	.72	.45
(SY)	91	-.44	.58	.49

* Independent Cluster Solution

Inter-Item Factor Correlations

	81	111	31	21	51	101	7	91
81	1							
111	-.42	1						
31	.46	-.42	1					
21	.31	-.34	.45	1				
51	-.19	-.40	.42	.27	1			
101	.31	.42	-.33	-.20	.34	1		
1	-.26	.21	-.21	-.22	-.19	.12	1	
91	.38	-.33	.35	.25	.38	-.44	-.18	1

Mean r = .310

% significant intercorrelation = 100

TABLE 11

FACTOR (IP)

Source	Item	Loading	Item Mean	Standard Deviation
(IP)	76	.70	.41	.49
(IP)	86	.65	.42	.49
(IP)	46	.64	.65	.48
(IP)	26	.59	.22	.41
(IP)	16	-.56	.61	.49
(IP)	66	-.53	.88	.32
(IP)	116	-.42	.26	.44
(IP)	96	-.43	.46	.50

Inter-Item Factor Correlations

	76	86	46	26	16	66	116	96
76	1							
86	.41	1						
46	-.41	-.40	1					
26	.32	.36	-.39	1				
16	-.25	-.30	.31	-.25	1			
66	-.25	-.21	.26	-.32	.26	1		
116	.19	.23	-.16	.23	-.17	-.15	1	
96	.27	-.16	.23	-.16	.12	.19	-.12	1

Mean r = .253

% significant intercorrelation = 100

TABLE 12

FACTOR (IF)

Source	Item	Loading	Item Mean	Standard Deviation
(IF)	48	.66	.51	.50
(IF)	78	-.61	.30	.46
(IF)	38	.59	.77	.42
(SY)	61	-.55	.68	.47
(IF)	88	.50	.44	.50
(SY)	41	.43	.67	.47
(IF)	58	-.41	.64	.48
(IF)	68	.40	.67	.47
(IF)	108	-.40	.59	.49

Inter-Item Factor Correlations

	48	78	38	61	88	41	58	68	108
48	1								
78	-.45	1							
38	.29	-.19	1						
61	.24	-.23	.42	1					
88	.41	-.28	.23	.13	1				
41	.22	.20	.40	.46	.04*	1			
58	-.24	.26	-.11	-.10*	-.21	-.14	1		
68	.36	-.30	.23	.14	.30	.13	-.13	1	
108	-.28	.25	-.20	-.13	-.22	-.13	.52	-.12	1

* not significant p <.01

Mean r = .234

% significant intercorrelation = 94

TABLE 13

FACTOR (AE)

Source	Item	Loading	Item Mean	Standard Deviation
(AE)	32	-.67	.32	.47
(AE)	62	-.67	.68	.47
(AE)	112	-.61	.52	.50
(AE)	102	-.57	.43	.50
(AE)	72	-.49	.49	.50
(AE)	42	-.43	.26	.44
(HM)	45	-.41	.54	.50
(TS)	30	-.40	.38	.49

Inter-Item Factor Correlations

	32	62	112	102	72	42	45	30
32	1							
62	.26	1						
112	.44	.44	1					
102	.42	.35	.41	1				
72	.34	.32	.34	.32	1			
42	.25	.31	.25	.20	.24	1		
45	.15	.16	.32	.37	.26	.19	1	
30	.37	.23	.30	.17	.30	.22	.18	1

Mean r = .30

% significant intercorrelation = 100

TABLE 14

FACTOR (HM)

Source	Item	Loading	Item Mean	Standard Deviation
(HM)	115	.67	.13	.34
(HM)	65	.65	.20	.40
(HM)	75	-.64	.80	.40
(HM)	75	.63	.28	.45
(AE)	92	.56	.20	.40
(HM)	85	.56	.29	.45
(HM)	35	.51	.23	.42
(HM)	95	.50	.32	.47
(HM)	105	.45	.06	.23

Inter-Item Factor Correlations

	115	65	25	75	92	85	35	95	105
115	1								
65	.21	1							
25	-.20	-.58	1						
75	.17	.65	-.51	1					
92	.37	.25	-.26	.21	1				
85	.29	.16	-.21	.17	.32	1			
35	.25	.21	-.27	.19	.27	.21	1		
95	.33	.16	-.13	.17	.32	.27	.21	1	
105	.23	.16	-.19	.21	.25	.20	.13	.14	1

Mean r = .252

% significant intercorrelation = 100

TABLE 15

FACTOR (PS)

Source	Item	Loading	Item Mean	Standard Deviation
(PS)	69	.83	.75	.43
(PS)	79	.57	.58	.49
(PS)	9	.53	.44	.50
(PS)	99	.53	.80	.40
(PS)	109	.50	.54	.50
(PS)	19	-.49	.22	.42
(PS)	39	.47	.27	.45
(PS)	89	-.47	.63	.48
(PS)	59	-.46	.40	.49
(PS)	119	-.46	.68	.47
(IF)	118	.41	.83	.37
(PS)	49	-.40	.11	.31

Inter-Item Factor Correlations

	69	79	9	99	109	19	39	89	59	119	118	49
69	1											
79	.42	1										
9	.37	.23	1									
99	.47	.21	.25	1								
109	.33	.17	.15	.25	1							
19	-.45	-.22	-.13	-.19	-.16	1						
39	-.45	-.19	-.18	-.20	-.15	.22	1					
89	-.28	-.19	-.24	-.20	-.18	.15	.32	1				
59	-.43	-.33	-.21	-.27	-.13	.18	.15	.24	1			
119	.46	.24	.16	.25	.18	-.20	-.20	-.23	-.16	1		
118	.31	.20	.18	.24	.19	-.13	-.28	-.16	-.16	.27	1	
49	-.28	-.14	-.15	-.22	-.15	.13	.15	.08*	-.13	-.15	.15	1

* not significant p<.01

Mean r = .225

% significant intercorrelation = 98

TABLE 16

FACTOR (AD)

Source	Item	Loading	Item Mean	Standard Deviation
(AD)	13	-.58	.41	.49
(AD)	103	-.57	.23	.42
(AD)	53	-.55	.34	.48
(AD)	83	-.53	.46	.50
(AD)	63	-.49	.55	.50
(AD)	3	-.49	.44	.50
(AD)	73	-.48	.36	.48
(AD)	93	-.48	.73	.44
(AD)	23	-.44	.52	.50

Inter-Item Factor Correlations

	13	103	53	83	63	3	73	93	23
13	1								
103	.17	1							
53	.44	.20	1						
83	.38	.11	.20	1					
63	.21	.26	.20	.22	1				
3	.17	.27	.18	.10*	.13	1			
73	.25	.18	.20	.44	.22	.10*	1		
93	.24	.20	.19	.31	.30	.11	.13	1	
23	.12	.19	.17	.17	.10*	.23	.11	.13	1

* not significant p<.01

Mean r = .236

% significant intercorrelation =90

TABLE 17

FACTOR (SG)

Source	Item	Loading	Item Mean	Standard Deviation
(SG)	4	-.65	.59	.49
(CC)	37	-.56	.35	.48
(SG)	44	-.51	.73	.44
(SG)	34	.51	.27	.45
(SG)	14	-.49	.65	.48
(SG)	24	-.43	.68	.47
(SG)	74	.43	.64	.48

Inter-Item Factor Correlations

	4	37	44	34	14	24	74
4	1						
37	.31	1					
44	.29	.24	1				
34	-.30	-.28	-.17	1			
14	.31	.32	.22	-.20	1		
24	.26	.20	.22	-.11	.23	1	
74	-.12	-.13	-.14	.11	-.14	-.06*	1

* not significant p<.01

Mean r = .208

% significant intercorrelation = 95

TABLE 18

FACTOR (TS)

Source	Item	Loading	Item Mean	Standard Deviation
(TS)	100	.69	.56	.50
(TS)	110	.61	.52	.50
(TS)	40	.61	.66	.47
(TS)	50	.60	.83	.38
(TS)	60	-.52	.36	.48
(TS)	120	.47	.77	.42
(TS)	90	.46	.70	.46

Inter-Item Factor Correlations

	100	110	40	50	60	120	90
100	1						
110	.27	1					
40	.47	.20	1				
50	.26	.25	.25	1			
60	-.21	-.17	-.23	-.26	1		
120	.14	.21	.20	.25	-.16	1	
90	.19	.23	.16	.23	.10*	.16	1

* not significant p<.01

Mean r = .219

% significant intercorrelation = 95

TABLE 19

FACTOR (CC)

Source	Item	Loading	Item Mean	Standard Deviation
(CC)	27	-.52	.70	.46
(CC)	77	-.50	.62	.49
(CC)	7	-.49	.86	.34
(CC)	87	-.48	.71	.45
(CC)	97	-.48	.68	.47
(CC)	57	-.41	.82	.38

Inter-Item Factor Correlations

	27	77	7	87	97	57
27	1					
77	.14	1				
7	.16	.20	1			
87	.24	.09*	.12	1		
97	.21	.33	.25	.12	1	
57	.22	.11	.17	-.06*	.19	1

* not significant p<.01

Mean r = .174

% significant intercorrelation = 86

TABLE 20

SUMMARY TABLE*

SY	AE	AD	SG	HM	IP	CC	IF	PS	TS
100%	100%	90 %	95%	100%	100%	86%	94 %	98%	95%

* Summary table of percent significant inter salient item correlations within factors.

An inspection of Table 5, Part 1 reveals an appreciable amount of obliquity between factors AE, HM, IF, and TS. Since obliquity is a function of the relationships of all the variables loading on two factors and not merely the relationships among the salients of two factors, it seems reasonable to determine whether the correlations among factors are primarily caused by a few factorially complex variables or whether the salient clusters are themselves correlated thus giving some grounds for a super order factor of neuroticism.

Accordingly, Table 21 presents the salients of each of the above factors and their intercorrelations, the average correlations of each salient cluster is calculated and reported.

TABLE 21

Average inter item correlation of the salients of factors and between salients of different factors

	AE	HM	TS	IF
AE	.29*			
HM	.15**	.25		
TS	.12	.08	.22	
IF	.17	.08	.07	.24

* diagonal values represent average intercorrelations of the salients >.40 of a factor

** off-diagonal values represent average correlations between the salient items of different factors

TABLE 22

Inter Factor Correlations*

	AE	HM	TS	IF
AE	1			
HM	-.53	1		
TS	.51	.35	1	
IF	-.40	.32	-.21	1

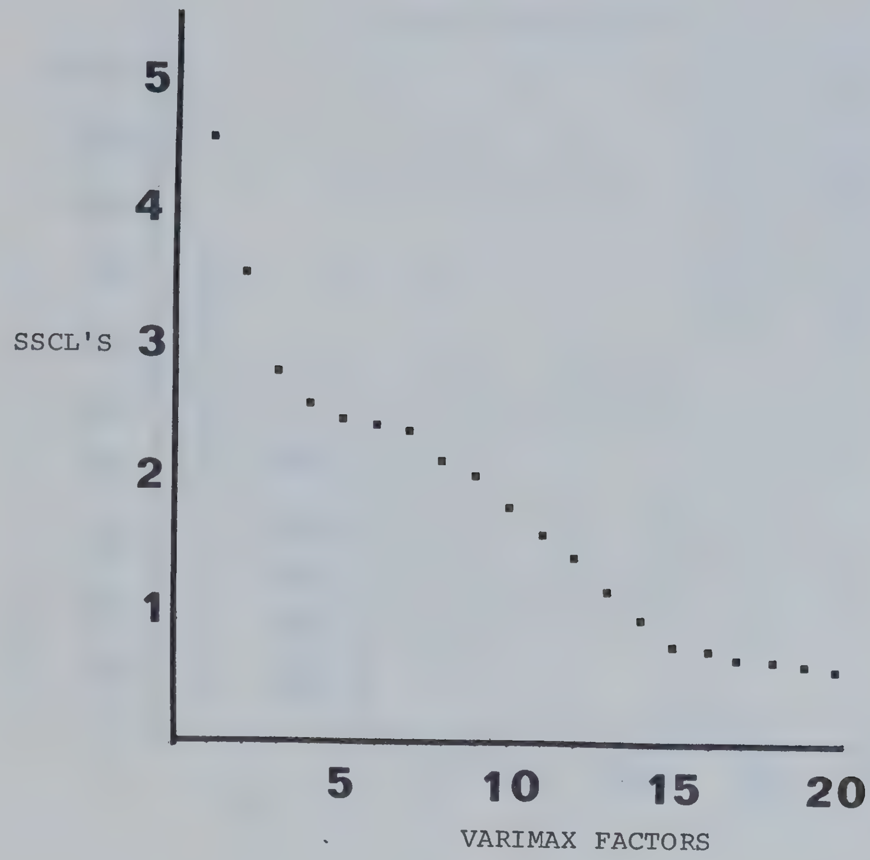
* It is noted e.g., that with an average inter item mean correlation of .08 between HM-TS an interfactor correlation of .35 is observed.

Part III

In this portion of the analysis, only the 120 questionnaire items and the sex variable are included. According to the preference indicated earlier, principal axis factoring was by way of the Image Analysis Model in which Harris Image factors are obtained, (Kaiser, 1970). Sixty-two factors had Harris eigenvalues >1. These eigenvalues are listed and illustrated in Fig. 4. On the assumption that a rotation of twenty factors would likely be an over-extraction twenty factors (see p. 26) were rotated (Varimax). The sums of squares of column loadings for these factors are plotted (Fig. 3). Inspection of the Varimax factors revealed that the significant variance was extracted by the fourteenth factor, i.e., factor fifteen had only one loading >.20 (variable 114). Factor fourteen had three such variables and factor thirteen was a doublet having variables (58, 108) loading >.40. Thus it is reasonable to conclude that after factor 14 all of the significant variance was extracted, nevertheless, to allow the first factors to expand, 15 factors were extracted and rotated (a) Independent Cluster solution and (b) A'A proportional to phi (Harris & Kaiser, 1964). The results of these two solutions are presented as well as the inter-factor correlations.

Figure 3

SSCL'S OF VARIMAX FACTORS



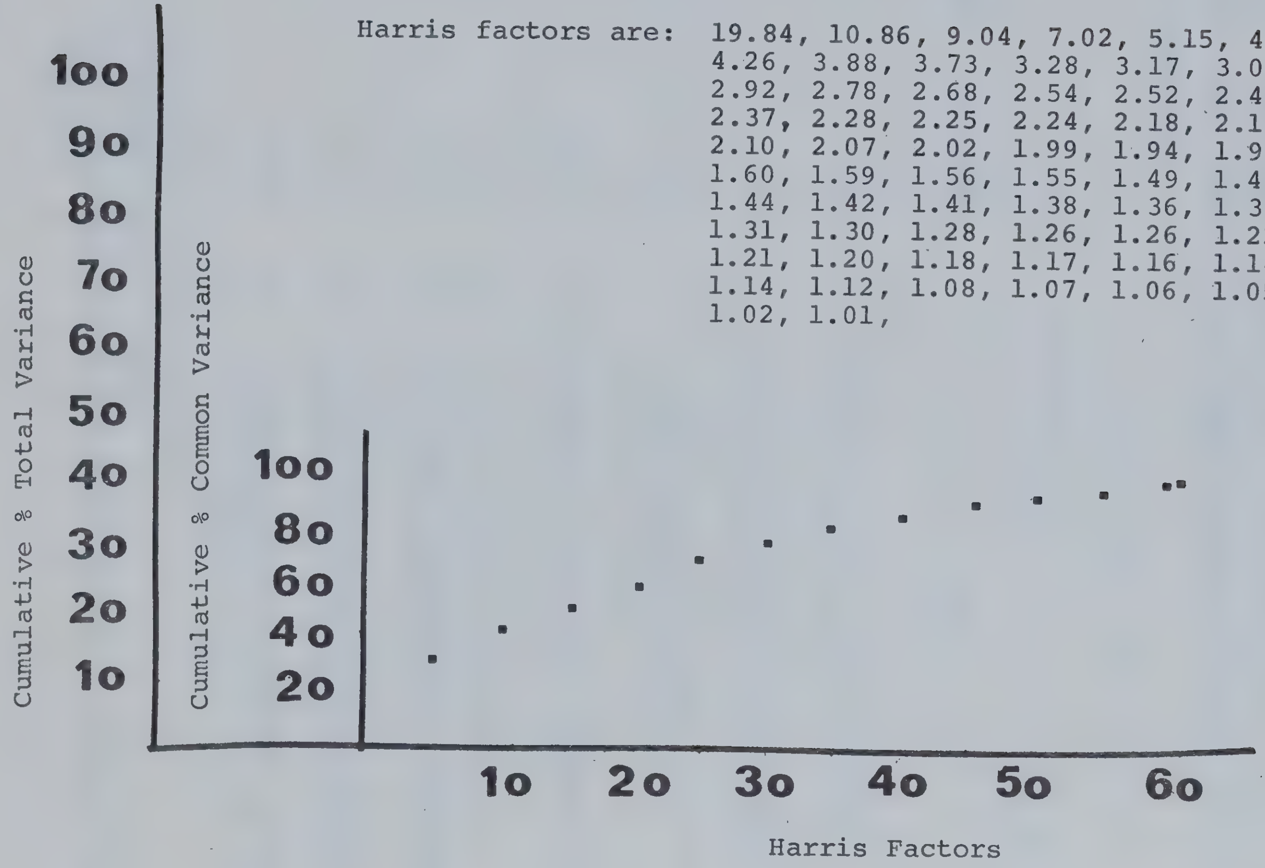
SSCL's are:

1.	4.58	11.	1.44
2.	3.59	12.	1.43
3.	2.78	13.	1.18
4.	2.56	14.	.95
5.	2.44	15.	.77
6.	2.43	16.	.74
7.	2.42	17.	.68
8.	2.12	18.	.64
9.	2.01	19.	.62
10.	1.78	20.	.58

Figure 4

CUMULATIVE VARIANCE OF HARRIS FACTORS

Harris factors are: 19.84, 10.86, 9.04, 7.02, 5.15, 4.37, 4.26, 3.88, 3.73, 3.28, 3.17, 3.09, 2.92, 2.78, 2.68, 2.54, 2.52, 2.44, 2.37, 2.28, 2.25, 2.24, 2.18, 2.15, 2.10, 2.07, 2.02, 1.99, 1.94, 1.93, 1.60, 1.59, 1.56, 1.55, 1.49, 1.49, 1.44, 1.42, 1.41, 1.38, 1.36, 1.34, 1.31, 1.30, 1.28, 1.26, 1.26, 1.22, 1.21, 1.20, 1.18, 1.17, 1.16, 1.14, 1.14, 1.12, 1.08, 1.07, 1.06, 1.05, 1.02, 1.01,



Proportions of Variance Accounted for

1. Sixty-two Harris eigenvalues accounted for 41.1% of the total variance among the items.

2. The first fifteen Harris eigenvalues of $S^{-1}RS^{-1}$ accounted for 53.4% of the common variance or 22.2% of the total variance.

FACTOR 1

Variable	Loading *	**	Item
32	.75	.50	I often feel "just miserable" for no good reason.
62	.53	.36	Sometimes quite trivial troubles keep going around in my mind.
112	.53	.36	I sometimes feel happy and sometimes depressed without any apparent reason.
102	.49	.34	Have you often felt listless or tired for no good reason.
5	.47	.32	I am inclined to be moody.
42	.45	.31	You feel lonesome even when you are with other people.
72	.45	.29	I am frequently over-annoyed by quite small setbacks.
82	.41	.27	I frequently worry about possible misfortunes.

* Independent Cluster solution

** A'A Proportional to Phi

Sums of squares of column loadings (SSCL) respectively 3.92, 2.52

FACTOR 2

Variable	Loading		Item
69	-.80	-.72	I persist on a job until it is completed even when others have given up.
79	-.60	-.47	I am able to work long hours without rest.
59	.48	.39	It is hard for me to work continuously on a scholarly problem.
39	.44	.40	My enthusiasm for a new project does not persist.
9	-.40	-.39	I am more persistent than most.
89	.40	.34	I find myself starting things and then losing interest in them.
99	-.40	-.39	When perplexed by a difficult problem I keep trying to solve it.

SSCL 3.20, 3.00

FACTOR 3

Variable	Loading		Item
38	.61	-.51	I am most often successful in dealing with people.
61	.60	-.51	It is easy for me to talk with people.
41	.59	-.52	I make new friendships easily.
91	.48	-.44	I am a sociable outgoing person.
71	.45	-.38	I am a good social mixer.

SSCL 2.58, 2.54

FACTOR 4

Variable	Loading		Item
31	.62	.58	I like to attend lots of social functions.
81	.60	.57	I enjoy parties where there are lots of people
111	-.59	-.56	I prefer to stay at home with a hobby rather than attend a lively party.
21	.59	.53	Do you like going out a lot?
51	.50	.49	At a party I like to meet as many people as I can.
SSCL	2.46, 2.63		

FACTOR 5

Variable	Loading		Item
46	-.61	.56	I seldom make decisions on the spur of the moment.
76	.57	-.54	On the whole I am rather an impulsive person.
86	.56	-.53	I often act on the first thought that comes into my head.
16	-.49	.45	I rarely act without careful consideration.
26	.46	-.45	I often act on suggestions quickly without stopping to think.
SSCL	2.36, 2.38		

FACTOR 6

Variable	Loading		Item
4	.55	.51	Individuals should always show respect for the law.
37	.54	.50	I always try to follow the golden rule.
14	.45	.43	Good manners are extremely important.
34	-.41	-.37	I prefer to go my own way rather than acting on approved rules.
SSCL	2.24, 2.23		

FACTOR 7

Variable	Loading		Item
13	-.55	-.49	When I work on a committee I like to take charge of things.
83	-.55	-.50	People say that I have leadership ability.
53	-.50	-.47	I like to "take command" by knowing what is best for my group.
73	-.44	-.41	People have told me I am a dominant person.
SSCL	2.21, 2.34		

FACTOR 8 (Independent Cluster)

48	-.52	Are you a self-confident person?
88	-.49	Very few events disturb my self-confidence.
78	.42	Are you troubled with feelings of inferiority?
SSCL	2.11	

FACTOR 8 (A'A Proportional to Phi)

68	.33	I feel confident that I will succeed in life.
SSCL	1.78	

FACTOR 9

100	-.55	-.50	Most people cheat if they can get away with it.
50	-.50	-.45	Many people try to get more than they give.
40	-.49	-.46	Most people will tell a lie to keep out of trouble.
110	-.47	-.44	There are many unreasonable people about.
60	.40	.35	Most people respect the rights of others.
SSCL	2.06, 2.04		

FACTOR 10

Variable	Loading		Item
115	.61	.51	Are you troubled by aches and pains?
92	.50	.44	Do you suffer from "nerves"?
95	.47	.40	Do you worry about your health?
SSCL	2.00, 1.86		

FACTOR 11

97	-.48	.38	I make a point of helping others.
7	-.42	.33	I am a co-operative and helpful person.
77	-.41	.33	To be helpful, I don't mind tackling a dirty job that others will not perform.
SSCL	1.89, 1.58		

FACTOR 12

65	.70	.68	I often lose sleep over my worries.
75	.67	.65	Do ideas run through your head and prevent you from sleeping?
25	-.62	-.59	I seldom suffer from sleeplessness.
SSCL	1.59, 2.11		

FACTOR 13

6	-.68	-.64	I enjoy taking risks just for fun.
116	-.64	-.61	I enjoy doing daring, foolhardy things.
36	-.44	-.43	Do people say you sometimes behave rashly?
SSCL	1.55, 1.78		

FACTOR 14 (Independent Cluster)

Variable	Loading	Item
58	.44	Are your feelings easily hurt?
SSCL 1.07		

FACTOR 14 (A'A Proportional to Phi)

Variable	Loading	Item
58	.54	Are your feelings easily hurt?
108	.47	Are you easily hurt when people find fault with you?
SSCL 2.51		

FACTOR 15

Variable	Loading	Item
115	-.26	I think I am more easy-going about right and wrong than most people.
29	.25	I believe that "if at first you don't succeed, try, try again".
SSCL .94		

Social Desirability

As pointed out in the introduction (Edwards, 1970, chpt. 17) has demonstrated in a factor analysis, a very strong relationship (r = .90) between social desirability ratings and the loadings on the first principal axis factor (Components model). Secondly for his data, 90 trait terms, a correlation between SD and percentage answering true (PT) of .92. This implies that SD and PT can for interpretive purposes be reasonably interposed. The hypothesis to be tested here, is that with a reasonable sampling of items from a domain, the hypothesis of social desirability responding (which bears an artifactual connotation) is virtually untenable and a more reasonable interpretation of a corre-

lation between SD and PT is a function of a third factor, namely the relation of these to adjustment. To explain:

(a) The first assumption and the easiest to make is that the trait of adjustment is normally distributed in the population.

(b) It is socially desirable to be well adjusted.

(c) 1. To be well adjusted, intends that one will not behave or possess traits which would lead him to exhibit extremely undesirable behavior.

2. Conversely, behavior which is extremely highly desirable, in the sense that it is highly undesirable not to possess it will indicate adjustment.

(d) Given (a) above, it follows that the more extreme a trait is in terms of "social undesirability" the less people are likely to possess it. Secondly in the sense of c (2) above the more highly desirable a trait the more people are likely to possess it. And thirdly, since extremely undesirable behavior or traits necessarily indicate maladjustment whereas only a certain group of highly desirable traits indicate adjustment, we can expect that type c (2) items will load less on the average than c (1) items on an adjustment factor.

(e) If we know the social desirability value of a variable, we should if it is extreme in sense c (1) or c (2) be able to predict its loading on an adjustment factor.

(f) If the first principal axis factor in an analysis is strictly a function of social desirability we should expect that items of neutral SD and hence of neutral means

should not correlate with such a factor.

(g) If variables of high and low means are correlated with an adjustment factor we should expect that the average loading of items on that factor should be approximately the same for different levels of means and SD values (with slightly less average correlation in the case of c (2) items.

In order to test these assumptions, the following analysis was undertaken:

(a) The correlation between the items means and the first principal axis factor (Image model) was computed. A PM correlation of .50 was obtained, in comparison to SD--first principal axis PM coefficient of .90 in the Edwards study.

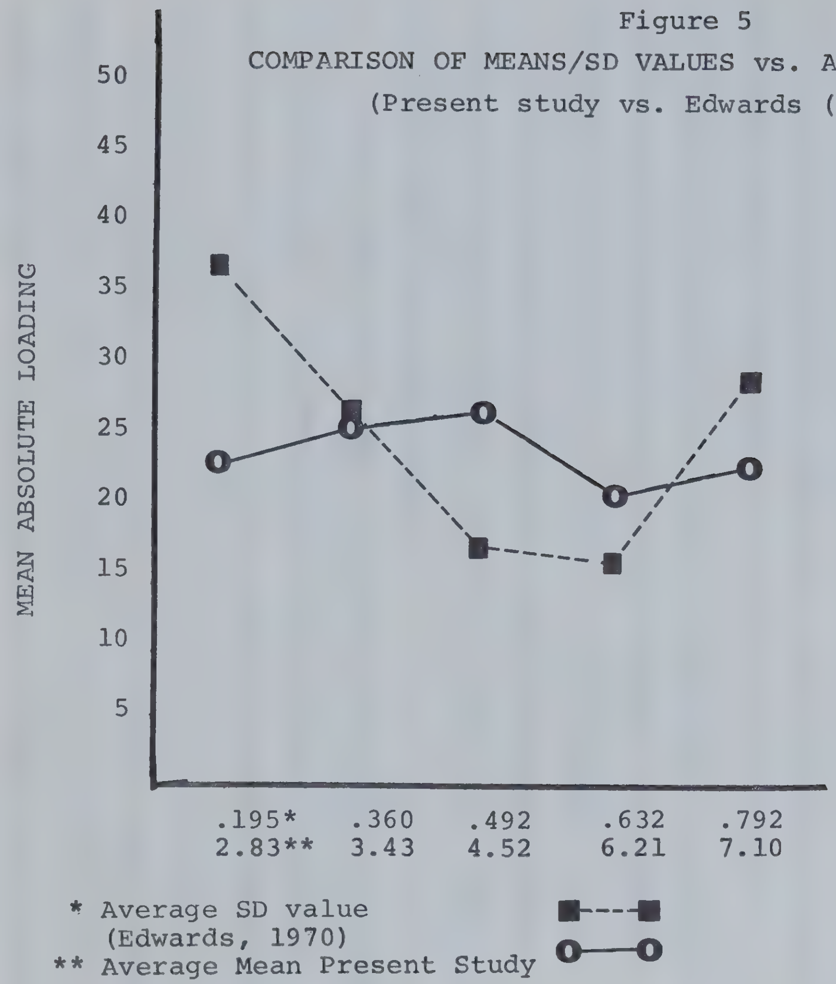
(b) The absolute first factor loadings were correlated with the SD values. In the case of Edwards data a coefficient of .49 was obtained, in this study the PM coefficient between absolute loadings and mean values was -.04. This is consistent with the interpretation that high SD values--high mean values, do not always indicate adjustment as their converse is likely too.

(c) The ninety trait terms were categorized in five groups of 18 traits, in terms of increasing SD value of traits. The 120 items of this study were categorized in five groups of 24 items, of increasing mean values. These means, the Z scores of which correlate .985, are plotted against the absolute average mean loading for a given group (Fig. 5) (the mean absolute loadings for Edwards data and this study are 26.5 and 25.5 respectively).

Figure 5

COMPARISON OF MEANS/SD VALUES vs. ABSOLUTE LOADINGS

(Present study vs. Edwards (1970))



The most important finding here is that the variance of loadings accounted for in terms of item means/SD values in this study is approximately 25% whereas in the Edwards study that figure is approximately 80%. This result facilitates an interpretation of "extremity responding" rather than social desirability responding. The quibble is to some extent one of semantics, but as the latter interpretation connotes a rather insignificant kind of trait, the PT/SD correlation is viewed by the author to be a function of the nature of the trait of adjustment which is somewhat paradoxical vis-à-vis trait theory i.e., generally if an item is extreme it indicates a high level of a trait and that item will not apply to the majority of people. An obvious exception is the trait of moderation. Assuming it is normally distributed in the population the majority of people will not possess traits in the extreme.

The loadings of immoderate trait indicators on the unrotated adjustment factor are interpretable as a component of adjustment--the golden mean.

Thus, while the author disagrees with Edwards concerning the labelling and the conceptual status of the "extremity phenomenon" he agrees that in one sense it may be desirable to partial out its variance or the variance of adjustment as a limiting factor on other traits. The case in mind, concerns items such as are found in the MMPI, e.g., "I almost always wish I were dead". If such an item, given that the criteria for inclusion in the MMPI was that it should discriminate

between normals and neurotics, is administered to a <u>normal</u> population, the majority of its variance will likely be accounted for in terms of its relationship to adjustment.

Again it must be emphasized that such items are likely not true of the majority of people, hence the dissatisfaction with Edward's term of social desirability responding and its connotations.

It should be noted however that even if items of rather highly biased means load on the first <u>unrotated</u> factor their lack of homogeneous adjustment consistency does not permit them in general to aggregate in terms of a single or several <u>rotated</u> factors of adjustment according to the criterion of saliency adopted in this study. Indeed, the low intercorrelations among highly biased items do not give rise to a common factor of extremity responding, although the hypothesis that item bias may in many instances indicate adjustment properties as well as otherwise separable trait content consistencies is sustained it appears that with veridical psychometric sampling the extent of bias will not greatly affect interpretation as trait consistencies appear to dominate (although type II errors are possible given the restricted covariance of such items). In this study, 17 items were found to be highly biased (defined as means >.80, <.20) of 136 possible significant correlations, ($p<.01$) only 17 were found to be significant, and at least 9 of these can be accounted for in terms of trait consistencies, i.e., they are between the items of the same putative factor; the matrix of biased item coefficients is presented (Table 23).

TABLE 23

CORRELATION MATRIX OF BIASED ITEMS

Mean	Item	7	8	17	18	20	28	29	33	49	50	65	66	94	98	105	115	118
.86	7	1																
.07	8	-.09	1															
.81	17	.13*	-.08	1														
.90	18	.05	-.18*	.03	1													
.11	20	.15*	-.02	.03	-.02	1												
.92	28	.02	-.05	.04	-.03	.01	1											
.88	29	.11	-.07	.05	.03	-.09	.09	1										
.91	33	-.09	-.01	-.02	-.01	.05	.09	.09	1									
.11	49	-.02	.08	-.02	-.10	-.01	-.04	-.17*	-.06	1								
.83	50	-.07	.04	-.02	-.02	.07	-.02	.08	.11	-.07	1							
.19	65	.06	.13*	.10	-.08	.10	-.07	.04	-.03	.05	.05	1						
.88	66	.10	.00	.06	.01	-.03	-.04	-.12*	.16*	-.09	.02	-.16*	1					
.11	94	-.10	-.04	.00	.04	.02	.08	.06	-.04	-.10	-.11*	-.01	.06	1				
.02	98	-.06	.04	.02	-.06	.05	.00	.02	-.07	.02	-.06	.09	-.08	-.02	1			
.06	105	-.06	-.01	-.03	-.07	.04	.01	-.04	.07	.07	-.04	.15*	-.13*	.04	.21*	1		
.13	115	.01	-.02	.04	-.01	.02	.05	-.01	.00	.00	.06	.22*	-.07	.03	.07	.23*	1	
.83	118	.05	-.20*	.05	.31*	.01	.06	.15	.04	-.10	.03	-.08	.06	-.08	-.05	-.04	.10	1

* significant (p<.01)

To summarize, Edwards (1970) proposes that in some factor analyses (Edwards, 1970, Chpt. 16, 17) the first unrotated principal axis factor can be interpreted as a SD-SUD factor. The hypothesis was advanced that such a result was a function of inadequate domain representation, particularly of normal range adjustment items.

In the present study, a correlation of .50 was observed between the item means and the loadings on the first principal axis factor. This result was taken to indicate that items of highly biased means were extreme and thus indicative of maladjustment, no evidence was obtained to warrant an interpretation that normals tend to view themselves in a better light than reality would permit, although even such a trait could be interpreted to be a function of adjustment.

Distribution Effects and Sex Specific Factors

As indicated earlier Berge (1972) has indicated that if a phi correlation matrix is dominated by distribution effects the loadings on the first unrotated principal axis factor will form a bell shaped function of the p-values of items with the highest loadings in the median p-value area. Such an effect was not demonstrated in the case of the first factor, however since a competing hypothesis (social-desirability) required an opposite distribution, (U-shape curve) in order to demonstrate that the first factor is not a function of the averaging of these two phenomena it must be

demonstrated that the distribution effect is not dominant in terms of the second principal axis factor. If a phi matrix is dominated by the distribution effect the second factor loadings will be an approximately linear function of the p-values (Berge, 1972, p. 915). To test this, PM coefficient was computed between the item means and the second factor loading. A coefficient of .218 was obtained corresponding to .047% in terms of variance accounted for. This relationship though not large is possibly owed to the distribution effect. It was indicated earlier that the items of the HPQ were chosen such as to not be biased sex wise. As witness to the success of that intent the loadings of the sex variable on the fifteen rotated factors (IC) in this analysis are presented: (AE) - .16, (PS) - .08, (SH) - .16, (SY) - .04, (IP) - .11, (SG) - .12, (AD) - .15, (IF) - .02, (TS) - .04, (HM) - .13, (CC) - .16, (SL) - .07, (RT) - .16, (ES) - .04, (Uninterpreted) - .22.

As an aside in relation to an issue discussed eralier (indifference of model) the mean and variance of the SMC's (lower bound estimate of communalities) for 62 factors in this analysis were .411 and .00714 (standard deviation .084) respectively. Thus for these data the factors can be expected to be robust across the three linear models discussed earlier.

	AE	PS	PR	SY	IP	SG	AD	IF	TS	HM	CC	SL	RT	ES
AE	1	.40*	.39	.19	-.21	.12	.02	-.57	.45	-.57	.40	-.48	-.24	-.39
		.12**	.16	.07	-.08	.02	.00	-.18	.20	-.21	.11	-.25	-.14	-.35
PS			.28	.08	-.33	.30	.33	-.55	.08	-.21	.44	-.13	.05	.11
			.10	.02	-.17	.15	.17	-.31	.01	-.01	.02	-.12	.05	.14
PR			1	.55	.13	.23	.28	-.36	.15	-.15	.51	-.12	.03	-.14
				.29	.05	.09	.13	-.16	.09	-.02	.20	-.07	.04	-.16
SY				1	.18	.24	.19	-.17	.10	-.06	.37	-.01	.14	-.16
					.09	.12	.08	-.05	.05	-.01	.15	-.02	.05	-.10
IP					1	-.16	.11	.12	-.03	.14	-.15	.14	.40	.00
						-.07	.05	.06	-.01	.04	-.05	.07	.22	.07
SG						1	.10	-.07	-.02	-.10	.46	-.16	.13	.06
							.05	-.05	-.04	-.03	.22	-.09	.07	.00
AD							1	-.38	-.20	.07	.23	-.08	-.28	.15
								.21	-.10	.04	.04	.01	.14	.07
IF								1	-.16	.40	-.33	.34	.06	.19
									-.02	.09	-.09	.16	.02	.24
TS									1	-.31	-.11	-.21	-.24	-.30
										-.12	.01	-.08	-.13	-.16
HM										1	-.22	.50	-.20	.33
											-.03	.26	.10	.24
CC											1	-.14	.03	-.06
												.00	.02	-.06
SL												1	.31	.15
													.17	.20
RT													1	.02
														.02
ES														1

* I.C. Solution

** $A^{1}A$ Proportional to phi

TABLE 24

IMAGE INTER-FACTOR CORRELATIONS

Factor Interpretations

The Independent Cluster (I.C.) and A'A proportional to phi solutions were indeed very similar. The constraint on obliquity in the latter resulted in a more equal distribution of the variance of AE, (Factor 1), IF (Factor 8) and Emotional Sensitivity (ES), (Factor 14). In the I.C. solution, AE assumes the conceptual status of a broad general factor, with IF and ES appearing to be relatively narrow related components. In general, the amount of obliquity indicated by the I.C. solution as discussed earlier does not indicate a need for higher order factoring, indeed while higher correlations (e.g., >.35) may indicate a consistent relationship, the actual position of the factor axis is largely a function of a few factorially complex variables. Interpretations should be made with this fact in mind. The I.C. solution is chosen as the basis for interpretation since it is the "ideal" solution for factorially simple data, (Harris & Kaiser, 1964; Hakstian, 1970) and secondly since no constraint short of factor collapse is placed on the obliquity of the solution it would seem to be most representative of the relationships among the factors.

Factor 1--Adjustment-emotionality (AE)

This factor closely resembles in terms of it's salients the Adjustment-emotionality factor of the HPQ--witness seven AE items loading >.40--and as such is considered a repli-

cation of that factor. The factor is a "general type of factor" i.e., the items which characterize it are broad statements about one's general emotional tonality. For that reason it appears to affect (correlate with) several other factors. Intuitively, this makes sense, adjustment and general level of emotionality would seem to be a limiting factor which would affect inter-personal relationships, persistence, etc. In practically every analysis of personality items, a similar factor appears to have emerged. Among the earliest indications of the factor is the first factor in Mosier's (1937) analysis which he termed "cycloid" characterized by items such as "ups and downs in mood" and "often just miserable".

Other possible relationships include Guilford's (1936) Emotionality (E), Sells et al. Emotional stability (1968), Howarth & Browne (1971, 1971a, 1972) AE, and of course the second factor (AE) to emerge from the Comprehensive Opinion Survey from which these items are mainly taken. Given that most of the factors appearing here have been found in one or more of the large analyses described earlier, the ensuing discussion will restrict itself to the relationships among the factors, the interpretation for the most part being self-evident.

Factor 2--Persistence (PS)

This factor leaves little doubt that the common element among the salients is persistence. Among the salients >.40

only items from source factor PS appear. Hence, the claim that the factor has been replicated. In this solution it appears to be moderately related to AE, IP, SG, AD and IF and CC. All of these relationships can be intuitively rationalized to make common sense, e.g., a person with a high Super-Ego or conscience would be more persistant through a sense of duty. However, the relationships are indeed only moderate and as persistence is conceptually separable from Super-Ego so is its variance.

Factor 3 and 4--Social Shyness (SH) and Sociability (SY)

It may appear at first glance that the source factor SY has been fissioned into two parts; to some extent this is so, however the sociability items 61, 71, 41, 91, were among the lowest salients in the Principal Components solution, (Part I). Here two clear components of sociability i.e., being at ease with people and gregariousness are found to be conceptually separable. The two factors are intercorrelated .55 in this solution, we know that since practically all the items in the source (SY) factor are significantly intercorrelated that this correlation though certainly a bit inflated is substantial. It is recommended that the two components of sociability mentioned above be measured separately.

Factor 5 and 13--Impulsivity (IP) and Risk Taking (RT)

The impulsivity factor has been replicated, but one component of impulsivity, risk taking has been fissioned to

form a triplet in terms of three highly intercorrelated items, e.g., 6 and 116 are correlated .62, the second highest correlation of any two items in the analysis. Items 6 and 116 are also correlated with the IP items generally, but another factor is required to account for the Risk Taking component of Impulsivity. This relationship is evidenced by the correlation between the two factors, i.e., .40. Risk Taking is relatively independent of all other factors in the analysis. A moderate correlation between Impulsivity and Persistence is also noted, i.e., -.33.

Factor 6--Super-Ego (SG)

This factor characterized by (SG) items, except for item 37 (CC) which is interpretable in the context of the items resembles those factors described in the introduction, namely Sells et al. (1968) (factor of "Consciençiousness") and Howarth et al., 1971a) factor called "Radicalism" and also labelled possibly Super-Ego.

Factor 7--Dominance (AD)

Factor seven requires little explanation, the common element is obvious and forms a replication of source factor (AD), Dominance as indicated by seven AD items loading in excess of (.35). It is relatively independent of all other factors except PS (.30) and IF (.38).

Factor 8 and 14--Inferiority (IF) and Emotional Sensitivity (ES)

Factor 8 is easily interpreted as inferiority, it is not a broad factor, i.e., the top three salients are rather tautological and is perhaps best viewed as a component of (AE), with which it correlated (-.57). Some of the lower loadings e.g., "If a person gets angry with me I try to calm them down" indicates the potential for a broader factor of self-confidence. Other (IF) items (58, 108) are fissioned from this source factor to form another rather narrow factor i.e., Emotional Sensitivity (ES) which is correlated with AE (-.39) and HM (.33) but very little with IF (.19).

Factor 9--Trust vs. Suspicion (TS)

This factor is entirely made up of salients (5) >.40 of (TS) source factor items. The dominant feature is one's attitude towards the good will or honesty of other people. The only appreciable correlation is with AE, (.45).

Factor 10 and 12--Hypochondriac Medical (HM) and Sleep (SL)

Except for item 92, "Do you suffer from nerves"? the salients >.40 are entirely derived from source factor (HM). A possible explanation for the intrusion of item 92 is simply that in the translation of the item a semantic equivalent was not obtained, i.e., literally translated "nerves" equal "nerf" but to suffer from the latter connotes a physical type of disorder when literally translated.

Perhaps a better translation would have been "nervosité". In any case the interpretation of the factor is adequately described by its title. In this analysis it correlates with AE (-.57) and IF (-.40). Items 65, 75, 25, have been fissioned from the source factor HM. These three items are highly intercorrelated and require another factor to explain the intercorrelations among them. The items appear to be related to HM (.50) and also to AE (-.48) and IF (.34).

Factor 11 and 15--Cooperative-Considerateness (CC)

The items of this factor consistently though not highly intercorrelated among its salients >.25 are included only items from source factor (CC). The factor is related to AE (.40), SH (.51), SY (.37), SG (.46) and IF (.33). Factor 15 merely indicates that the common variance has been accounted for; witness a highest loading of -.26.

Discussion and Conclusion

This study must be considered the first part of a two part study. That is, the fact that the variables analyzed in this study have never been factor analyzed together in a single study in English does not permit any precise inter-cultural comparison between English and French speaking students in Canada. A second analysis[45] based on English speaking students will however, provide such a basis for comparison. In spite of this, it is possible in view of the remarkable results obtained, to state rather unequivocally that the factors of the HPQ have in general been found to be transcultural with respect to French and English speaking students in Canada. Throughout this study the orientation has been toward determining the empirical referents of a given trait. In the absence of a factor pattern based on the English version, it is impossible to determine which variables may be culturally specific, if any. The results do provide (given that the empirical factors derived, are as faithful to the hypothesized structure as one would expect from an English

45 This analysis has been carried out by Dr. Howarth and the results are even more encouraging, if possible, and are in agreement with those reported in the present thesis.

sample) a basis for generally evaluating the factorial validity of the HPQ.

Replicability of the Factors

In Part I of the analysis the scale scores were included so as to provide a reasonable estimate of the factor purity of each of the scales. The results indicated that not only are the scales relatively factor pure, e.g., (mean loading of .887 in the Independent Cluster solution) but also that they are robust across a variety of rotational criteria. Among these (see Table 3) the least confirmatory rotation was a 12 factor varimax rotation, yet it realized a mean scale loading of .825. This comparatively lower mean was largely due to the fissioning of the Inferiority scale into two factors, one part of which combined with the AE factor. This suggests that Varimax may be sub-optimal when a large number of factors are present.

In view of the above one must conclude that the scales, although certainly imporvable, were relatively "factor pure" in the case that, except for a few intrusions mentioned above, practically all of the items were found in the empirical solution to be faithful to their hypothesized position, i.e., SY, IP, IF, AE, HM, PS, AD, IF, TS, and CC retained 10, 12, 8, 10, 10, 12, 10, 10, 9, 10 items respectively loading in excess of $\pm$ 25 in the I.C. solution. Thus, despite a translation of the items from English into French, these putative scales demonstrated reasonably good factorial

purity and replicability. Moreover, in the subsequent analysis, in which scale scores were left out of the analysis, and a different factor analytic model (Image Analysis) as well as different criteria for the number of factors to retain, was employed, the ten factors of the HPQ appeared to be generally confirmed. While looking forward to a more exact comparison of factor pattern matrices, the present evidence suggests that the factor structure of the HPQ is stable and replicable.

Indeed, the prominent distinguishing characteristic of these factors is their replicability when one considers other "factor systems" such as Guilford and Cattell. Basically it appears that the reasonable research strategy requires that analysis begin at the item level. It is conceded that items are not highly reliable, e.g., even practically tautologous items do not correlate highly--all the more reason for factor analysis of items. It is likely the only method which can discover both homogeneity and specificity among items with any amount of accuracy. The low reliability of items is unfortunate, but can be compensated by large factor analyses as indicated by the replicability of the factors of the HPQ.

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APPENDIX I

Howarth Personality Questionnaire

1. Je préfère passer les vacances "loin de la foule".
2. Je trouve qu'il est facile d'oublier mes soucis et de me détendre.
3. Je suis souvent porté à faire un effort spécial pour remporter la discussion contre quelqu'un.
4. Une personne devrait toujours montrer du respect à l'égard de la loi.
5. Je suis porté à être maussade.
6. Je prends plaisir à courir des risques pour m'amuser.
7. Je suis une personne serviable qui aime à coopérer.
8. Je crois être une personne qui ne réussit pas.
9. Je suis plus persévérant que la plupart des autres.
10. Je me demande souvent pour quels motifs cachés une personne se montre aimable à mon égard.
11. Trouvez-vous qu'il est difficile de bien vous amuser à une soirée plein d'entrain?
12. Il m'arrive quelquefois de penser que la vie ne vaut pas la peine d'être vécue.
13. Lorsque je fais partie d'un comité j'aime bien me charger de la conduite des affaires.
14. Il est très important d'avoir de bonnes manières.
15. Vous êtes ennuyé par des craintes et des aversions peu communes.
16. J'agis rarement sans grande réflexion.
17. Je développe très peu souvent une aversion irraisonnée à l'égard d'une autre personne.
18. La plupart du temps je parviens au but que je me suis désigné.
19. Je cède facilement.

20. Les autres s'attribuent souvent le mérite de vos succès.

21. Est-ce que vous aimez sortir beaucoup?

22. Les gens disent ou font souvent des choses qui m'agaçent.

23. Dans les réunions je m'élève contre ceux qui me semblent avoir tort.

24. J'admire mes parents sur tous leurs points importants.

25. Je souffre rarement d'insomnie.

26. Souvent j'agis à la suite d'une suggestion sans m'arrêter pour penser.

27. Dans une assemblée je fais ce qui est nécessaire pour maintenir l'harmonie.

28. Lors d'une sociale les gens habituellement sont heureux de me voir.

29. Je crois en ceci: "si au début vous ne réussissez pas, essayez, essayez encore".

30. Il arrive un temps où il semble que tous le monde est contre vous.

31. J'aime bien être présent à de nombreuses activités sociales.

32. Je me sens souvent tout à fait malheureux sans raison réelle.

33. J'aime qu'on écoute bien attentivement ce que j'ai à dire.

34. Je préfère suivre ma propre voie plutôt que d'agir selon les règles établies.

35. Je souffre parfois de violents maux de tête.

36. Est-ceque les gens vous disent que vous vous conduisez parfois imprudemment?

37. J'essaie toujours de suivre la règle par excellence.

38. La plupart du temps j'ai beaucoup de succès dans mes rapports avec les gens.

39. Mon enthousiasme pour une nouvelle entreprise ne persiste pas.

40. La plupart des gens vont mentir pour éviter des ennuis.

41. Je me crée facilement de nouvelles amitiés.

42. Vous vous ennuyez même lorsque vous êtes avec d'autres personnes.

43. J'ai ordinairement raison dans les choses importantes.

44. Je crois fermement que les églises méritent notre appui financier.

45. Il me manque parfois d'énergie quand j'en ai besoin.

46. Je prends rarement des décisions sous l'impulsion du moment.

47. J'oublie vite si une autre personne prend temporairement avantage de ma bienveillance.

48. Etes-vous une personne sûre d'elle-même?

49. Je suis porté à considérer mon travail avec indifférence.

50. Bien des gens essaient de retirer plus qu'ils ne donnent.

51. Lors d'une réunion j'aime bien rencontrer autant de monde que possible.

52. Je suis facilement démonté et bouleversé.

53. J'aime bien prendre le commandement d'un groupe en démontrant que je sais ce qu'il y a de mieux pour lui.

54. Je pense que les normes morales s'écroulent.

55. Je me sens presque toujours dispos et fort.

56. Les autres pensent que je suis très sérieux.

57. J'essaie toujours de faire aux autres ce que j'aimerais qu'ils me fassent.

58. Est-ce que vos sentiments sont facilement blessés?

59. Il m'est difficile de travailler continuellement sur un problème profond.

60. La plupart des gens respectent les droits des autres.

61. Il m'est facile de parler avec les gens.

62. Parfois des soucis tout à fait insignifiants me flottent dans l'esprit.

63. Je prédomine sur plusieurs de mes connaissances qui sont de mon âge.

64. Ce pays aurait besoin d'un niveau de conduite plus élevé.

65. Mes soucis m'empêchent souvent de dormir.

66. Je crois en ce dicton:"regardez avant de sauter".

67. Si on me demandait de participer à une campagne de charité je dirais poliment que je suis occupé.

68. Je suis convaincu que je vais réussir dans la vie.

69. Je persiste dans mon effort jusqu'à la fin, même lorsque les autres ont abandonné.

70. Plus d'une fois on a sérieusement manqué d'égards envers moi.

71. Je sais me rendre sympathique dans tous les milieux.

72. Je suis souvent très contrarié par de petits échecs.

73. On m'a dit que je suis une personne dominatrice.

74. Je suis d'accord avec la moralité sexuelle de nos jours.

75. Est-ce que des idées vous accaparent l'esprit et vous empêchent de dormir?

76. En somme je suis plutôt une personne impulsive.

77. Pour être serviable, je n'hésite pas à attaquer une tâche répugnante que d'autres ne feraient pas.

78. Etes-vous tourmenté par des sentiments d'infériorité?

79. Je suis capable de travailler de longues heures sans me reposer.

80. Je me méfie des gens que je viens de rencontrer jusqu'à ce que je les connaisse mieux.

81. Je jouis des réunions où il y a beaucoup de monde.

82. Je m'inquiète souvent au sujet de malheurs éventuels.

83. On dit que j'ai des aptitudes de chef.

84. Je suis bien préoccupé par les moeurs de ma génération.

85. Avez-vous souvent des battements de coeur ou des palpitations?

86. J'agis souvent à la suite de ma première idée qui me vient à l'esprit.

87. Si une personne se fâche contre moi, j'essaie de la calmer.

88. Très peu d'incidents ébranlent mon assurance.

89. Il m'arrive d'entreprendre quelque chose et d'en perdre ensuite l'intérêt.

90. Je doute parfois des motifs des autres.

91. Je suis une personne sociable et expensive.

92. Souffrez-vous des "nerfs".

93. Mon opinion influence souvent les autres.

94. On peut avoir la certitude que la police ne maltraitera pas les personnes innocentes.

95. Vous inquiétez-vous au sujet de votre santé?

96. L'impulsion irrésistible ne fait pas partie de ma constitution.

97. Je me fais un devoir d'aider les autres.

98. Ma vie n'a été qu'une déception jusqu'à présent.

99. Quand je suis embarrassé par un problème difficile, je m'acharne à le résoudre.

100. La plupart des gens vont tricher s'ils peuvent s'ils peuvent s'en tirer de cette façon.

101. En général je m'efface lors des rencontres sociales.

102. Vous êtes-vous souvent senti nonchalant et fatigué sans vrai raison?

103. Les gens qui discutent avec moi généralement ont le dessous.

104. J'ai souvent contrarié les désirs de mes parents.

105. Avez-vous fréquement des attaques de frémissement et de tremblement?

106. Je dis ordinairement ce que j'ai envie de dire au moment même.

107. Je me retrouve facilement en train d'arranger les problèmes des autres.

108. Etes-vous facilement blessé si on trouve à redire contre vous?

109. Quelles que soient les difficultés je m'en tiens à mes intentions premières.

110. Il y a bien des gens déraisonnables autour de nous.

111. Je préfère rester à la maison avec un passe-temp favori que de participer à une réunion plein d'entrain.

112. Je me sens parfois heureux, parfois déprimé sans raison apparente.

113. Trouvez-vous très difficile d'accepter un "non" comme réponse?

114. Je crois que je suis plus insouciant au sujet du bien et du mal que la plupart des gens.

115. Etes-vous incommodé par des maux et des souffrances?

116. Je prends plaisir à faire des choses audacieuses et imprudentes.

117. J'évite de critiquer les autres.

118. En général je réussis à faire tout ce que j'entreprends.

119. On me considère une personne très énergique.

120. Les gens croient se soucier plus les uns des autres qu'ils ne le font en réalité.

APPENDIX II

Summary of Numbers of Marker Items with Principal Factor Loadings on the 18 Promax Factors[a]

Source Factor		No. Source Items	No. Markers by Promax Factor 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	No. Items with Zero Markers
G	G	14	1	1		1	2	1			10										0
	A	20	1	3											8						8
	M	20		1	1	3		1				1		1			1	2	7	3	7
	I	24	5			1		1	1		6		1								9
	N	19	16																		3
	S	21	2	16																	3
	T	11	2											3				1			5
	D	14	10						1												3
	C	21	16						2												3
	R	17	4	2													4				7
	O	16	6						1				1					2			6
	Ag	16						1	2	1			1	1	2						8
	Co	32						2		17		1	1	1	1						9
	AA	20			20																0
	CC	25				12		1		1	2										9
C	A	20		1			10					1									8
	C	20	5			2			2			1	1	1							7
	D	19	3					1	9						1	1			1		4
	E	19	1			5			1		3				3		1				5
	F	19	1	7		2	2				1						3				3
	G	19	1			11		3									2				2
	H	19	1	10											2						6
	I	19				1	5				1	4									8
	J	18		2				1	2	1				1	1		2	2			6
	L	16				1			6	4											5
	M	16	4			1			2			3		1					1		4
	N	16				3	2	1				1		2							7
	O	16	5					1	2										2		6
	Q_1	16	1		1	1		1				2		1							9
	Q_2	16	1	2	1			2						1	1						8
	Q_3	16	5			2			2								1				6
	Q_4	16	7			1			2							1	1				4
G (220)		300	63	23	21	17	2	7	7	19	18	2	4	6	11	0	5	5	7	3	80
C (202)		300	35	22	2	30	19	10	28	5	5	12	1	7	8	2	10	2	4	0	98
Total (422)		600	98	45	23	47	21	17	35	24	23	14	5	13	19	2	15	7	11	3	178

[a]Only items with factor loadings of .20 or higher are included.

From (Sells et al., 1970, p. 417)

Summary of Numbers of Salient Items on 18 Promax Factors[a]

Source Factor		No. Source Items	No. Salients by Promax Factor 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Zero Salient Items
G	G	14	2	1		1		1			11			1			1				0
	A	20	5	7					2					1	9	1	2				3
	M	30	3	2	3	8	6	1	3		1	4		1			1	2	11	7	2
	I	24	10	1		1		4	1	8	8		2	1	3	1	2		1		3
	N	19	18						2		3		1	2		1	1			2	1
	S	21	4	19				1			2	1	1		2		3				0
	T	11	5		1									5		2	1	6			1
	D	14	12					3	1		1						5				1
	C	21	18					1	3		1					1	3	3			1
	R	17	4	5	1	2		1	2					2	1	1	7	1			0
	O	16	11					1	2				2	1	1	2		2			0
	Ag	16	2					2	4	2			1	3	6				1		4
	Co	32	1			1		7	1	21		1	3	1	1		1				1
	AA	20			20		1	1													0
	CC	25				17		5		4	2	2									5
C	A	20		5	1		12	1	1			5			2			1		1	2
	C	20	8			3		1	2			1	1	2	1		2		1	1	3
	D	19	7					2	10		1		1		1	1			1		2
	E	19	1			5			1		3	1	1	1	3	1	1		1	1	5
	F	19	3	12	1	4	2		1		1	2		1			8		1		0
	G	19	1			12		4				2					2				2
	H	19	4	15		2			1					1	6	1	2				1
	I	19	1		1	6	6	1			1	6					1		1	1	2
	J	18		3				1	3	1		1		1	1		3	2		1	4
	L	16	1			1			6	4					2		1	1			4
	M	16	4		1	2	1		2			4		1	1				1		4
	N	16	3		1	5	2	2	1			1		2			1		1		2
	O	16	12	1				2	3		1				1	1	2		3	1	2
	Q_1	16	1		1	1	1	1				3		4				1			6
	Q_2	16	4	3	1			3			1			3	1						6
	Q_3	16	5		1	3			4	1			1			1	2			1	4
	Q_4	16	12			1			3		1		1			3	3		1		0
																					Total
Guilford		300	95	35	25	30	7	28	21	27	29	8	10	18	23	9	27	14	13	9	428
Cattell		300	67	39	8	45	24	18	38	6	9	26	5	16	19	8	28	5	11	7	379
Total		600	162	74	33	75	31	46	59	33	38	34	15	34	42	17	55	19	24	16	807

[a]Salient items are defined as having factor loadings of .20 or higher, regardless of loadings on other factors.

From (Sells et al., 1970, p. 418)